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PRIMARY HEALTH EDUCATION DURING PREGNANCY: A PROGRAMMED APPROACH

by

© PATRICIA L. SULLIVAN

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled PRIMARY HEALTH EDUCATION DURING PREGNANCY: A PROGRAMMED APPROACH, submitted by Patricia L. Sullivan in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

ABSTRACT

Ninety-nine pregnant women were randomly assigned to one of two groups (experimental and control) and were pretested. Based on the scores obtained on the pretest, the subjects were divided into three performance level groups (high, medium and low). All subjects in the experimental groups received an instructional program on the characteristics and care of newborns which consisted of four programmed instruction booklets and an accompanying set of color slides. When the instructional program had been completed, the experimental subjects were posttested. The subjects in the control group received no treatment between the pretest and posttest occasions. The average time interval between pretest and posttest occasions for both the experimental and control groups was five days.

The results indicated that the instructional program was highly effective. It had the effect of raising the subjects' level of content knowledge to criterion regardless of their level of entering behavior. The findings of the study indicated that the use of Glaser's modified teaching model for the development of a linear, self-instructional primary health education program resulted in an effective instructional product. Subjects' responses to the instructional program were strongly positive. This, combined with a zero attrition rate, seemed to indicate that the use of this type of approach in a specific primary health education program can be highly motivating.

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CHAPTER I

PROBLEM AND BACKGROUND

The purpose of this study was to determine empirically if using a specific instructional strategy for the development of a linear self-instructional, primary health education program to teach pregnant women about the characteristics and care of newborn infants resulted in an effective educational product.

This chapter is divided into three sections. In section one, the instructional strategies used to apply psychological concepts and principles to educational practice, the problems associated with their use, and the emergence of relatively new ways of viewing the instructional process are described. In section two, the concept of health education is described, the effectiveness of the use of conventional methods for health teaching is presented, and the introduction of programmed instruction into health care settings is outlined. In section three, each of the components of Glaser's modified teaching model is described. As linear programming techniques were used in the development of the instructional procedures for the experimental program used in this study, the variables characteristic of programming, and literature associated with their use is discussed under the instructional procedures component of the model.

Instructional Strategies

The application of psychological concepts and principles to

improve educational practice is the aim of educational psychology. The two strategies most generally used in applying psychology to education have involved direct experimental research on learning in school settings, and the distillation of a set of propositions about learning and human nature from basic research which teachers try to apply in the classroom. The results of using these two strategies have, however, resulted in research findings which have been largely inconclusive (Anderson & Faust, 1974).

Various possible reasons have been advanced for the inconclusive results of these studies. One major reason seems to point to the fact that studies have been frequently undertaken which attempted to compare the effectiveness of two or more teaching methods, when the methods under consideration had not been developed to the point where their individual effectiveness had been demonstrated. The second major reason for the inconclusive results seems to be related to the problem of generalizability in psychology and other social sciences. The high degree of empiricism which characterizes the social sciences reduces the capacity of psychology and other social sciences to generalize to new situations. This causes difficulty when attempts are made to translate general conceptions of learning into workable instructional techniques. Since the ability of psychology to predict which teaching methods and arrangements of materials will result in maximized student learning is only modest, the actual effectiveness of instructional methods and materials can be determined only when they are tried (Anderson & Faust, 1974).

In an attempt to indicate the great need to test programs empirically in order to determine their effectiveness prior

to making them available for adoption, Lumsden (1974) reported the testimony of Komoski, the president and director of Educational Products Information Exchange Institute (EPIE) before the House Select Committee on Education and Labor of the U. S. Congress. In his testimony, Komoski estimated that 99% of the teaching materials being used in the United States had never been systematically assessed to determine the extent to which students learn from them (Lumsden, 1974). Lumsden goes on to cite allegations made by EPIE that programmed instruction is ". . . by far the most discouraging area it has investigated" (p. 146), in that only 7% of some 633 currently used programmed instructional materials examined, had revealed evidence of program effectiveness.

A further indication of the need to test empirically the effectiveness of programs was suggested in a study by Rothkopf (1963). After having determined experimentally the effectiveness of seven self-instructional programs, Rothkopf had twelve high school teachers and principals, who had just completed a course on programmed instruction, predict the effectiveness of the programs by reading them. The rank-order correlation between the teachers and principals' predictions and the demonstrated effectiveness of the programs was -.75.

As a result of the problems experienced and the inconclusive research results obtained, attempts have been made to develop new ways of viewing the instructional process. Glaser (1962) has developed the component phases of an instructional system which was modified and renamed a basic teaching model by DeCecco and Crawford (1974); Anderson and Faust (1974) have outlined a strategy for developing effective

instruction; Davis, Alexander and Yelon (1974) have developed a strategy of learning system design, while Gagné and Briggs (1974) describe the steps in instructional system development. (See Appendix A for outlines of these instructional models, strategies and systems.)

Basically it appears that all of the instructional models, strategies or systems identified above have two key features: the approach is systematic, and every aspect of it is evaluated in relation to its effectiveness with learners. All strategies emphasize the importance of specifying objectives for instruction; assessing student characteristics; and developing instructional procedures to facilitate student achievement of the knowledge, attitudes and skills indicated by the objectives. Student performance is assessed in relation to achievement of the instructional objectives, and instructional procedures are redesigned to assure that all students meet the objectives specified. Utilization of an instructional process incorporating these components usually results in effective instruction (Anderson, 1967, 1969; Glaser, 1964; Tiemann, Paden & McIntyre, 1966). Anderson and Faust (1974) state that the use of such a proposed strategy will prove to be more effective than older strategies because it provides a framework which enables one to apply psychological principles to instructional practice; and as well, it ensures that instructional procedures are refined until their effectivenss is proven. Others who have supported the use of this process in instructional development have been Gerlach and Ely (1971); Kemp (1971); Merrill and Boutwell (1973); and Popham and Baker (1970).

Because DeCecco's and Crawford's (1974) modification of Glaser's (1962) component phases of an instructional system incorporates the major

features of the other instructional models, strategies and systems, and appears to be parsimonious, practical and generalizable to wide ranges of teaching, it was used in developing the instructional program for this study.

Health Education

Health practitioners have seldom perceived patient teaching as an activity of high priority (Skiff, 1965). Major shifts and rapid changes in the way in which health and medical care are organized, financed, and delivered has led to an emerging interest in preventive medicine and patient education (Somers, 1975; Spiegel, 1967; Young, Buckley, Wechsler & Demone, 1969).

The traditional emphasis on the therapeutic system is one that is costly in relation to the health of the individual, the nation and the state of the health care economy. Somers (1975) states that " . . . the almost exclusive concentration on the traditional health care system has resulted in the current $100 billion U. S. health care bill and the 10 to 15 percent annual increases" (p. 11); less than 5 percent of this total is spent on all preventive health programs taken together. The need for a more sensible balance between preventive and therapeutic medicine seems obvious. For a preventive system to be successful in raising the health status of the individual, the nation, and the health care economy, a great deal more emphasis needs to be placed on developing sound programs for health education.

Health education can be defined as helping learners to understand and apply knowledge about health and illness (Pohl, 1973). It can be classified as being primary, secondary, or tertiary. Primary

health education is concerned with teaching people to promote health and prevent illness. Secondary health education focuses on helping people to acquire an understanding of minor illnesses, the early stages of serious disease, and appropriate use of health services; while tertiary health education is aimed at assisting those having experienced a chronic illness to achieve their health potential (Evans, 1974).

Health education programs conducted by health professionals, namely nurse practitioners and physicians, have utilized both individual and group instruction methods. Group methods, such as lectures, demonstrations and discussions are most frequently used in teaching the importance of health principles and practices, appropriate to their conditions, to pregnant women and diabetics. Apart from the educational programs directed toward these two groups, little attempt to promote health education on a systematic basis has been made (Evans, 1974).

Individual health education is used by health professionals where a one-to-one relationship exists between the nurse and patient or the physician and patient, such as in a consultation, clinic, or hospital situation. Spiegel (1967) has indicated that most professionals find a one-to-one teaching relationship the most effective. Dalzell (1965) in comparing three methods of teaching maternity patients, found that individual counselling was more effective than teaching done during prenatal classes and home visits.

Pike (1973) has identified that the family doctor has a good opportunity to communicate ideas about healthy living with his patients during the time of consultation. However, he has also indicated that

patients have difficulty taking in information at this time. The difficulty patients have "taking in" information at this time may be associated with a possible increase in level of anxiety which may be related to the condition for which medical assistance was sought. Furthermore, the amount and/or complexity of the information conveyed orally to a patient at any one time may be too great for the individual to retain and thus, subsequently use.

The concept of the nurse as a health educator was introduced around the beginning of the century (Carpenter, 1967), and doctors have been involved in health education, "knowingly or unknowingly", long before the term health education was used (Tyser, 1975). The literature, however, does not seem to indicate that the teaching efforts of health practitioners have been particularly effective when effectiveness is measured by the knowledge and understanding patients have of their conditions and/or treatments. For example, Etzwiler (1962) conducted a study of diabetic children and their parents and found that many were poorly informed about their conditions. Studies of adult diabetics reported a similar lack of knowledge and understanding (Beaser, 1956; Stone, 1961; MacDonald, 1968). In a study of patients discharged from hospital, Spiegel (1967) found that more than fifty percent left the hospital without adequate knowledge of home care procedures. Clinite and Kabat's (1969) study indicated that only three of thirty patients, who were instructed about their medications prior to discharge from hospital, took their medications as prescribed.

A possible reason for this apparent ineffectiveness may be traced to the professional preparation programs of the health practitioners. Medical and nursing preparation programs have

traditionally prepared students to perform care-taking functions in a therapeutically-oriented system. Although prospective practitioners may be introducted to health teaching as a function of their roles, the attention directed toward preparing them to assume this responsibility has not been extensive. Thus, many may enter the health care system lacking adequate knowledge and skills to assume responsibility for health education. A 1963 study of the teaching activities of 1,500 nursing practitioners in the United States, for example, showed that "over 900 stated their preparation for teaching was either lacking or inadequate for their purposes as practicing graduate nurses" (Pohl, 1973, p. iv). Redman (1968) identified lack of knowledge about content, inadequate knowledge and utilization of teaching skills, and lack of responsibility in assuming the functions of a health teacher as the major reasons many hospital nurses do not teach.

Because professional time is expensive and frequently limited in supply, relatively few nurses and physicians have the time that is needed to plan, conduct and evaluate instructional programs. Observations made by the author regarding the instructional activities conducted in many health care settings would seem to indicate that much of the time spent on developing instructional programs is directed to outlining and presenting specific content. Frequently, instructional objectives are vaguely stated; instructional procedures related to the educational objectives are rarely specified; and evaluation of programs, if conducted at all, often seems to be unsystematic and opinion based.

By virtue of their positions in the health care system, physicians, and particularly nurse practitioners, have the opportunity to interact with patients at a time when these people are likely to be particularly conscious of their health, and thus, possibly interested in, and responsive to, health education. Although at least some nurse practitioners and physicians have been responsive to the need patients have for health education, the selected literature reviewed from the last decade, as well as professional and personal experience, has led this author to question the quality, consistency and effectiveness of much of the teaching activity which is currently being conducted in health care settings. Generally, it would seem that few health professionals have the time, educational knowledge and expertise necessary to develop, implement, and evaluate health education programs. With health education assuming a position of higher priority in the health care system, the need for demonstrably effective and efficient instructional programs is becoming particularly urgent.

Experimentation with health education for diabetics has probably been influenced by the fact that millions of people are afflicted with this disease which, if controlled, will enable them to lead active and productive lives (Etzwiler, 1972). In an effort, therefore, to advance the art of diabetic teaching and to conserve increasingly scarce professional time, the Diabetes and Arthritis Program, Division of Chronic Diseases, Public Health Service contracted with the Medical Foundation, Inc., in Boston, Massachusetts, to field test programmed instruction in diabetic patient education. This was an attempt to determine whether this method, never before used with a patient group, could be used as a teaching tool in the health field

(Skiff, 1965). A teaching machine was used to present an automated instructional program on diabetic care. The group studied consisted of 184 diabetic patients and 56 non-diabetics. Findings indicated that this approach was effective in increasing the learning of patients of a wide range of ages, education, occupational levels, intelligence and reading skills. Furthermore, patients reported that their learning experience was positive and that they could "attend and concentrate more effectively through this method than by participation in classes or by reading a book" (Skiff, 1965, p. 413).

Spiegel (1967), reporting on the same study, concluded that the programmed instruction could make a significant contribution to diabetic education practices. He also reported on a field study in which physicians took a review course on diabetes utilizing a programmed instruction approach. He suggested that this is a way in which programmed instruction can be used to influence patient education. Following the completion of the course, all physicians reported that the course was worthwhile, and fifty percent indicated that they would make changes in their practice. Spiegel (1967) further stated that:

> programmed instruction offers physicians, nurses and other health professionals the opportunity to ensure that their patients have a reliable, accurate, and efficient method of securing information that is vital to their recovery (p. 962).

He further stated that:

> the future of health care in this country points clearly to the mounting need for effective utilization of new educational techniques in the education of patients and in the area of preventive medicine. Programmed instruction is one of the tools which should be used to its fullest possibilities in meeting these obligations (Spiegel, 1967, p. 962).

A study which evolved from the field trials of the Medical Foundations Inc. was that of Young, Buckley, Wechsler, and Demone (1969) who tried to assess the effectiveness and acceptance of using programmed instruction to teach adult diabetic patients. A baseline group, so called because it did not meet the requirements usually implied by the term "control" group in experimental design, received the regular clinic training provided by the nurses and physicians. The experimental group received a programmed filmstrip on diabetes in a teaching machine, in addition to the regular training which was provided by the clinic nurses and physicians. Results reported indicated a significant increase in the scores of the experimental group from pretest to posttest. Their study, however, reported some serious limitations. Because of the sampling techniques used, as well as possible confounding factors which occurred during the study, the gains between the pretest and posttest scores of the experimental group could have been due to factors other than the use of the experimental treatment. Sixty-eight percent of the subjects in the experimental group and 28 percent of those in the baseline group dropped out of the study. The results reported were based on only those subjects who remained in the study. The authors also indicated that there was no evidence that the program had been evaluated prior to its being used; and no behavioral objectives were specified for the program prior to its use.

Etzwiler and Robb (1972) studied the acceptance and effectiveness of programmed instruction with juvenile diabetics and their families. The study used the same type of teaching machine and the same filmstrip on diabetes which was used in the study done by Young et al. (1969). The Etzwiler and Robb study did not report

design problems. The method of instruction was found to significantly increase the basic knowledge of diabetes and its management among the juvenile diabetics and their parents. Furthermore, it was found that the increased level of knowledge was retained when subjects were tested three months later. Children between the ages of 9 and 12 years expressed difficulty understanding the vocabulary used in the program; however, those between the ages of 13 and 18 had no difficulty with it. Generally the reaction of children and their parents toward the method of instruction was positive.

Clark and Bayley (1972) developed and evaluated the use of programmed instruction for patients maintained on warfarin therapy. Rather than using a teaching machine, the study used programmed instruction booklets. Subjects using the programmed instruction about warfarin learned significantly more than did subjects receiving written instructions or no instruction. An interesting finding, which supported a premise of the need for improved patient teaching, was noted when patients who had taken anticoagulants prior to the study, did not score significantly higher on the posttest of knowledge of warfarin than did subjects who had never before taken the drug. These authors concluded by suggesting that programs could be developed and evaluated for patient use to teach about various illnesses, diagnostic tests, and therapeutic plans of treatment to help patients recognize their health needs and ways to meet them.

Because of the therapeutic orientation of the present health care system, it is not surprising to find that the experimental use of programmed instruction seems to have been tried only in secondary and tertiary health education programs. Its effectiveness as an

instructional method seems to have been demonstrated in teaching acutely or chronically ill people about their conditions and/or treatments; however, its use in teaching well people to promote health and prevent illness has not been, to this author's knowledge, previously studied.

Since increased attention is, and will continue to be, given to preventive health care in the future, primary health education programs, employing effective instructional methods, need to be developed. Programmed instruction seems to be a potentially valuable method which could increase the effectiveness of patient learning in primary health education programs, insure uniform quality of instruction, and decrease the demand made of health professionals who generally lack adequate knowledge, skills and time for traditional teaching activities.

Generally, it would appear that the use of programmed instruction methods in a primary health education program could make a positive contribution to improving the effectiveness and efficiency of present health education activities. For this reason, it was used as an instructional method in the development of a specific primary health education program designed to teach pregnant women about the characteristics and care of newborns.

A Basic Teaching Model

Glaser's modified teaching model (DeCecco & Crawford, 1974) as a conceptualization of the teaching process, contains four major components. In this section, each of the components will be identified and described in relation to the contribution it makes to the total

instructional process.

Component 1: Instructional Objectives

"An objective is an intent communicated by a statement describing a proposed change in a learner -- a statement of what the learner is to be like when he has successfully completed a learning experience" (Mager, 1962, p. 3). A well-formulated objective, according to Mager, meets three criteria: It specifies the behavior the student will demonstrate following instruction; it describes the condition under which the behavior is expected to occur; and it identifies the standard of performance which is considered acceptable. Explicitly stated objectives can provide guidance for planning instructional procedures that will facilitate student achievement. They are also useful in developing assessment procedures which accurately reflect the objectives which will permit a student to demonstrate his achievement of the instructional objective. Furthermore, they may be of assistance to students by making clear what it is that is to be accomplished in a particular instructional unit so that he may direct his attention and efforts toward those ends (DeCecco & Crawford, 1974).

The use of instructional objectives was advocated by Bobitt as far back as 1920, and interest in them was revitalized by Tyler in 1934 and again in 1950. However, it seemed to be Mager's (1962) book, Preparing Instructional Objectives that stimulated the current interest and controversy regarding the usefulness and effectiveness of instructional objectives in relation to teaching and learning (Lawson, 1974). In the midst of many articles proclaiming the advantages and disadvantages of instructional objectives as an educational tool, Eisner (1967) indicated that the question of their

effectiveness should be answered by empirical study rather than through logical argumentation.

Results of the studies which examined the effects of instructional objectives on learning have been inconclusive. Duchastel and Merrill (1973) reviewed studies in which students either were, or were not, provided with instructional objectives. Approximately half of these studies reported that the use of objectives facilitated student achievement while an equal number showed no significant differences attributable to their use. In no case, however, was the use of objectives found to inhibit student achievement.

In reviewing studies of objectives in which programmed instruction or computer-assisted instruction materials were used, an interesting finding was noted. For example, studies by Smith (1967), Stedman (1970), Merrill and Towle (1972) and Zimmerman (1972) all found that providing students with instructional objectives did not result in achievement which differed significantly from those who were not given objectives. Tobias and Duchastel (1974) suggested that achievement may be relatively unaffected by the explicit statement of objectives when used with instructional materials which have been developed according to a systems or behavioral model because the content in these programs is implicitly well structured around the objectives. They further suggested that in instructional situations where materials are not as well structured, explicit statement of objectives may help the student to structure the material and thus facilitate his achievement. This reflects an earlier suggestion made in a study by Jenkins and Deno (1971) which found no significant effect related to providing students and/or their teachers with specific

and general objectives in an educational psychology course. The authors suggested that their findings could have been attributed to the fact that people who have never before been exposed to objectives may not know how to use them; and that their use in a well-structured program may actually be redundant for people using it. One of the most useful effects of instructional objectives, they concluded, may be their indirect contribution to learning by influencing the design of instructional materials.

Task analysis. With the increased attention being given to analyses and investigations of the instructional process by psychologists, the reality of the complexity of learning tasks in instructional situations, as opposed to those typically studied in laboratory settings has necessitated that new ways of analyzing tasks and specifying the content of learning be developed (Glaser & Resnick, 1972). The process of task analysis is now being recognized as an integral part of the technology of instruction. Task analysis usually, but not necessarily, follows the definition of objectives for while the instructional objectives (or task description) specify the tasks to be accomplished, the process of task analysis indicates the series of skills the learner must perform in order to accomplish the objective (Anderson & Faust, 1974).

Anderson and Faust (1974) describe task analysis as a process which "describes the subskills and subconcepts a student must acquire in order to master a complex skill or an interrelated set of concepts and principles" (p. 82). Gagné (1974) further elaborates on the definition of task analysis by stating that the process involves identifying

and classifying the behavioral contributors to task competence so that optimal conditions for their learning can be identified.

The analysis of instructional tasks by rational or experimental means permits formulation and testing of inferences concerning optimal instructional processes (Glaser & Resnick, 1972). Task analysis is thus more than a series of procedures applied to instructional design because the whole process contributes to the description and prediction of human performance and achievement. For this reason, the process of task analysis, as part of an instructional design framework, can be theoretically justified (Davies, 1973). Task analysis is seen, therefore, as a valuable part of instructional design and has been described by Duncan (1972) as one of the overall contributions which programmed instruction has made to educational technology.

Although various approaches to task analysis have been identified, the techniques suggested for use are not as well developed as those available for task description (Gagné, 1965). Davies (1973) has indicated that while many of the proposed schemata for task analysis have logical appeal at a theoretical level, relatively few have been found to be of practical value in instructional decision-making. Furthermore, because of the present state of development of task analysis as an aspect of instructional design, Davies has indicated that the approaches available for task analysis will constantly be subject to revision or reformulation on the basis of evolving empirical evidence that will either confirm or refute some of the assumptions underlying the process.

Of most interest for the purpose of this study are the methods for classifying learning outcomes implied by instructional tasks which have been developed by Bloom, Englehart, Faust, Hill and Krathwohl (1956) and Gagné (1970).

Bloom et al. (1956) developed the Taxonomy of Educational Objectives for the cognitive domain. This taxonomy is a system for classifying cognitive behavior in which knowledge and intellectual abilities and skills are specified as two broad categories which produce six classes of behavior (knowledge, comprehension, application, analysis, synthesis and evaluation). The taxonomy is organized hierarchically representing simple to complex classes of behavior with the simpler behaviors viewed as components of more complex behavior.

Gagné (1970) has identified five categories of learned capabilities representing learning outcomes: intellectual skills, cognitive strategies, verbal information, motor skills and attitudes. He further specifies the various conditions that influence learning for each category of learned capability.

The intellectual skills category of learned capability is the one identified by Gagné as being of greatest importance to school learning, and thus, the one providing the best structural model for instructional design (Gagné, 1974). The intellectual skills category is broken down into eight subcategories (signal learning, stimulus-response learning, chaining, verbal associations, discriminations, concepts, rules, and problem solving) which represent different classes of performance to which different sets of internal and external conditions of learning apply. These subcategories of intellectual skills are arranged hierarchically with the lower or simpler skills

being prerequisite or subordinate to the higher or more complex intellectual skills. Support for Gagné's intellectual skills hierarchy postulate has accumulated, but little evidence exists, at the present time, to support a hierarchical nature of the categories of verbal information, motor skills and attitudes (Briggs, 1968). Gagné's subcategories of intellectual skills represent a broad range of behaviors. Objectives which are classified by these subcategories of intellectual skills can also be classified according to the subcategories of intellectual skills and abilities of Bloom et al. (1956).

The taxomonic classification system developed by Bloom and his associates (1956) has been criticized by Gagné (1965), and DeCecco and Crawford (1974) because the system fails to state objectives explicitly and specify behavior classes distinctly. This, they believe, results in difficulty in classifying objectives and the subsequent conditions appropriate for learning. Gagné's system of classification may be more useful for task analysis because it incorporates explicitly stated objectives and behavioral categories. As a result, greater precision in instructional design may be obtained (DeCecco & Crawford, 1974). Davies (1973) also identifies Gagné's system as one of the few that can be practically helpful in making effective instructional decisions.

Gagné's system of task analysis seems to be a potentially valuable, practical and relatively precise method for identifying sequences of en route objectives and optimum sequences for presentation of subject matter. For these reasons, it was used in the development of the instructional program for this study.

Component 2: Entering Behavior

Entering behavior describes the present level of a learner's knowledge and skill in relation to specified objectives which are to be obtained by completing an instructional unit (DeCecco & Crawford, 1974; Popham, 1973). It includes an assessment of the prerequisite skills which the student must possess to begin the instructional unit, as well as the student's skill in relation to enabling and terminal objectives. An assessment of entering behavior is usually made by pretesting; i.e., testing the student prior to initiating instruction (Anderson & Faust, 1974).

Assessment of entering behavior is usually conducted following the process of task analysis which aims to identify and clarify the component skills and subskills of the instructional objectives. At the point in task analysis where the subskills are part of the student's behavioral repertoire, the process of task analysis is considered to have been conducted in sufficient detail. It is then necessary to design instructional procedures which will take the learner from the level of performance indicated in the entering behavior assessment to the level specified in the terminal objectives (Anderson & Faust, 1974).

Entering behavior assessment is considered to be a vital part of the instructional design model because it provides data which indicates whether or not the student has the prerequisite abilities, knowledge, or skills needed to achieve the instructional objectives. If the prerequisite behavior of the student is considered to be inadequate, the objectives and/or the instructional procedures may

need to be modified to help prevent under-achievement. Likewise, it is important to determine whether or not students already know the material that one is planning to teach. Students who enter the instructional situation with more competence than assumed may need to have the objectives and/or the instructional procedures modified so their learning can be enhanced and boredom with the instructional program can be prevented (Anderson & Faust, 1974).

Assessing the entering behavior of each student provides data for modification of instructional objectives and procedures based on student needs so that instruction can be individualized (Anderson & Faust, 1974). The information obtained from this assessment can also be compared with student performance data on a posttest, following the completion of an instructional unit, so that an indication of the effectiveness of the instructional procedures may be obtained (Popham, 1973).

Component 3: Instructional Procedures

"Instruction is a set of procedures for producing a change in behavior (learning) toward a prestated objective" (Becker, Englemann & Thomas, 1975, p. 1). Instructional procedures are external to the learner and deliberately arranged by the teacher or lesson designer. Essentially, they are a set of communications to the student which are supplied to the student by the teacher, text or materials with which the student interacts. Instructional procedures are intended to facilitate learning by activating and supporting the internal processes of learning (Gagné & Briggs, 1974). In order for an instructional system to be effective, it must provide procedures for motivating the learner and directing attention to the task to be learned; providing a vehicle of instruction;

obtaining learner responses; reinforcing correct responses and correcting errors; and evaluating mastery (Becker, Englemann & Thomas, 1975).

Programmed instruction provided the basis for the development of the instructional procedures component of the teaching model. For this reason, a brief history of programmed instruction is presented. This is followed by a review of the literature on programming variables used in the development of the experimental program in this study.

Both psychologists and educators have influenced the development of programmed instruction. Some of those considered to have the greatest relevance to the subject have been Ivan Pavlov, Edward Thorndike, Sidney Pressey, B. F. Skinner, and Norman Crowder (Pipe, 1966).

Pavlov, a Russian physiologist contributed to the development of programmed instruction by his classical conditioning studies; while Thorndike, an American psychologist, made a contribution with the postulation of his laws of effect and exercise. Pressey developed the first system of programming as well as a teaching machine. In his system, he incorporated Thorndike's laws of effect and exercise by building in both rewards and repetition.

B. F. Skinner, the investigator and formulator of many of the basic laws of operant conditioning, attempted to apply his findings from experimental work with animals to human learners in classroom settings. His system of linear programming is characterized by presenting a small amount of material to be learned in a frame (stimulus), to which the student responds (response). After the student responds, he is given the correct answer. Confirmation of the correct answer is considered to be reinforcing, or rewarding, to the

student. The steps in this type of program are small and, therefore, the error rate is low. Responses are overt and constructed, and although students move through the program at their own speed, all students proceed through the same steps. Skinner's (1954) article, "The Science of Learning and the Art of Teaching" stimulated so much research on programmed instruction that Schramm (1964) reported that "no method of instruction has ever come into use surrounded by so much research activity; indeed for a time it seemed that there would be more research than programs" (p. 1).

Norman Crowder is associated with branching, or intrinsic, programming. In a branching program, a student proceeds from frame to to frame in a linear fashion until an error is made. At this point, he or she is "branched" to supplementary material designed to correct the misconception. While all students in a linear program follow the same path throughout the program, the responses of each student in a branching program determine the path, or route, to be taken for subsequent learning tasks (Pipe, 1966). The steps in a branching program are larger than those used in linear programs, and they provide the student with more information at each step. Branching programming characteristically employs a multiple-choice reponse format from which the student is required to select his response. The branching method of programming is intended to provide the student with a learning experience resembling communication with a live tutor (Bigge & Hunt, 1968).

Research has indicated that many kinds of students learn from programmed instruction whether the programs used are linear or branching, or whether they are presented in texts or on machines.

Studies have accumulated which have investigated the variables considered to be characteristic of programming. Six of these variables, as well as one variable not necessarily considered characteristic of programming, but of particular interest in this study, are outlined below and literature relevant to these variables is described.

Sequencing. Those interested in instruction have assumed that the way in which instructional materials are presented to students will have an effect on their learning (Anderson, Faust, Roderick, Cunningham & Andre, 1969). Although logical sequencing in programmed instruction is more intuitively appealing to educators, studies done on the relationship between sequencing and test performance with normal children and college students generally seem to indicate that little difference in performance between groups exists after exposure to logical, systematic instructional sequences and those sequences of an illogical, random or scrambled nature (Hamilton, 1964: Jacobs & Kulkarni, 1965; Levin & Baker, 1963; Maurer & Jacobs, 1966; Niedermeyer, Brown & Sulzen, 1969; Payne, Krathwohl & Gordon, 1967; Roe, Case & Roe, 1962).

Payne, Krathwohl and Gordon's (1967) study of scrambled vs. logical sequencing of three instructional programs on basic concepts of educational measurement failed to find logical organization to be superior to the scrambled order sequence for 195 college sophomores. They suggested that these sophisticated learners didn't seem to require an externally imposed logical organization of instructional materials because they are able to reconstruct scrambled

material and code it in a way which facilitates learning and remembering. Wodtke, Brown, Sands and Fredericks (1967) studied the interactive effects of verbal ability and random or ordered instructional sequencing. They suggested that high ability subjects may be able to conceptualize a randomly ordered sequence so that their performance on random and ordered sequences would not differ, whereas lower ability subjects would perform better when an ordered sequence was externally imposed. They concluded that " . . . the effects of scrambling a logically ordered instructional program depend on the nature of the learning task and on individual differences in the learner" (p. 15).

Hirrell (1971) studied high, medium and low ability seventh grade children using non-verbal learning materials to determine the effects of sequencing, cueing and individual response on performance. Cueing was found to significantly effect the performance of the low-ability level student; and logical sequencing was significant for both middle and low ability levels. Regardless of the program techniques used, the high ability students performed equally well.

Gagné (1973) in a review of literature on sequencing programs for intellectual skills reported the studies done by Niedermeyer, Brown and Sulzen (1969) and Brown (1970). Gagné indicated that the findings of these studies suggest that it may be more important to hierarchically sequence programs that have rule-using and problem-solving objectives than programs that don't require skill attainment because the former programs require successive mastery of intellectual skills.

Niedermeyer and his associates (1969) used the guided discovery Number Series material which Gagné and Brown used in their 1961 study of concept formation involving grade nine students. In comparing three versions of frame order, logical, scrambled and reverse, they found that the logically-ordered group was the only one that performed significantly better than the control group on a test of concepts and problem-solving. Although the logically-ordered group made fewer program errors, and found their program interesting, none of the three sequence groups showed significant posttest differences.

Brown (1970) used the same math materials as Niedermeyer et al. (1969) in a study of sequencing instruction for grade ten and eleven trigonometry students. He found that the logically-ordered group performed reliably better than the scrambled or control group in terms of the time it took them to complete the program, the number of errors made on the program, and the number of errors made on a test of complex, problem-solving skills.

Both Niedermeyer and his associates (1969), and Brown (1970) found some evidence which indicated that students of high ability were less adversely affected by "scrambled" or "unstructured" sequences in mathematics than were those students of lower ability (Allen, 1975).

Tobias (1973a) suggested that a reason for failure to find significant differences in achievement due to sequence may be attributable to the fact that subjects were familiar with the program content before taking it. If subjects had prior familiarization, then they would probably have a somewhat organized body of knowledge for the content that would be relatively unaffected by the sequence in which the material was presented. If, however, subjects lacked prior familiarization, and thus an organized body of knowledge for the

content, scrambling or randomizing frames might significantly reduce achievement. Using educational psychology students as subjects, Tobias (1973a) studied the effect of sequence on achievement using two sets of programmed instruction materials which dealt with familiar and technical information about heart disease. Results indicated that the use of a logical type of sequence had a significant effect on the learning of unfamiliar, or technical material, but resulted in no significant difference with familiar material.

A study done to extend this finding to computer-assisted instruction was conducted by Tobias and Duchastel (1974). They used the technical part of the program on heart disease used by Tobias (1973a) and obtained similar results. They concluded that frame sequence does affect the amount learned and the ease with which material is learned.

Although the evidence is not conclusive, it does suggest that the effects of sequencing instructional materials may depend on the ability of the student, the nature of the learning task, and the student's prior familiarity with the material to be learned. Generally it would seem that the lower ability student may be more adversely affected by a scrambled sequence than would a higher ability student who could possibly conceptualize a randomly-ordered sequence with greater facility (Hirrell, 1971; Payne, Krathwohl & Gordon, 1967; Wodtke, Brown, Sands & Fredericks, 1967). The logical, or hierarchical, sequence may have a facilitative effect on learning for all ability groups especially when the sequenced materials deal with intellectual skills attainment (Brown, 1970; Gagné, 1973; Niedermeyer, Brown & Sulzen, 1969). The most supportive evidence at

this time is related to the prior familiarity hypothesis of Tobias (1973) and Tobias and Duchastel (1974). It appears as though a logical sequence significantly affects the learning of unfamiliar technical material possibly by providing an organizing structure for the new material, thus contributing to the ease and amount learned.

Prompting. A prompt is a stimulus that already controls, or partly controls, a response which is used to teach new responses and help establish stimulus control. Prompts can include rules, hints, and synonyms which help a student make a correct response, as well as techniques such as copying frames, underlining, italicizing, or providing letters of the word required for a response (Anderson & Faust, 1974).

Angell and Lumsdaine (1961) studied complete vs. partial prompting using paired-associate items with volunteer adult subjects. In this study, complete prompting involved the use of prompts throughout the program while partial prompting consisted of using a procedure in which every third trial was an unprompted test trial. Results indicated that a condition of partial prompting resulted in significantly more learning than providing only prompting, or only confirmation.

A study on prompting and confirmation reported by Anderson (1967) was that done by Stolurow and Lippert (1964) in which vocabulary learning and retention by mentally retarded children was studied. Their results indicated that fewer training errors were evidenced in the group that received the prompting procedure. They also found an interaction between degree of overlearning defined as

the number of repeated trials following achievement of criterion level, and method of training. The confirmation procedure resulted in greater achievement when there was much overlearning, while with little overlearning, prompting led to greater effectiveness.

In a study of prompting by Anderson and Faust (1967) an English-Russian word pair learning task was presented in the format of programmed booklets. In one condition, the response terms in the pair were underlined. In another condition, they were not. Results indicated that students performed significantly better in the no-underline condition. The authors believed that inadequate inspection behavior may have been encouraged by the underlining procedure.

Gagné and Rowher (1969) reported a study by Simon and Jackson (1968) on concept identification learning. They studied the effect of placing a dot over the relevant dimension of the stimulus in one condition; placing it over the irrelevant dimension of the stimulus in a second condition; and using no dots in a third condition. The task required subjects to classify upper and lower case letters into two groups. Fewest errors resulted from the treatment in which the relevant dot was used, while the irrelevant dot resulted in most errors.

Anderson (1967) has suggested that while prompting procedures may lead to more rapid response learning, high levels of associative learning are not assured mainly because in some situations, students can respond correctly without attending to the appropriate stimulus. Anderson and Faust (1974) have indicated that when new responses are being taught, copying and imitative prompts can facilitate learning. However, in establishing stimulus control, prompts may assist learning if they focus on the discriminative stimulus. In this type of

learning situation, unprompted response opportunities should be required of the student so that an indication that appropriate learning has actually occurred can be obtained.

The results of the studies reviewed seem somewhat contradictory, i.e., in one condition of prompting, learning was facilitated (Simon & Jackson, 1968), while in another, it was not (Anderson & Faust, 1966). Difficulty in obtaining direction for the development of instructional materials arises from the fact that the studies reported were conducted with simple verbal learning tasks using paired-associate lists, rather than complex tasks such as using prose materials. It would seem that in complex verbal learning tasks, the learner would have even more opportunity to attend to the less relevant aspects of the stimulus materials than would be the case in simple verbal learning tasks. The suggestions made by Anderson (1967) and Anderson and Faust (1974) would seem, therefore, to provide some direction for the use of prompted and unprompted responses in the development of instructional programs, i.e., prompts may be used to facilitate response learning, but in order to assist in establishing stimulus control they should direct the learner's attention to the discriminative stimulus. Prompts should then be gradually withdrawn or faded, and unprompted responses should be required to assure that appropriate learning has occurred.

Responding. Active responding to the instructional program is considered to be a distinctive feature of programmed instruction. However, studies done on programmed instruction in which the type of response required is varied have not indicated that making active,

or overt responses actually results in increased achievement over other response formats (Anderson, 1967; Tobias, 1973b). The variations in the response format used in these studies have been described as: reading format, which requires the student to read a filled-in response blank without making an overt response; covert response format, which requires the student to "think" the answer without responding overtly; constructed response format, which requires a student to construct a written answer; and multiple-choice format which requires the student to choose and record a response from a list of multiple-choice alternatives (Tobias, 1973b).

Anderson (1967) has indicated that in spite of the ambiguous findings regarding the response mode issue, overt responding can have a facilitating effect on learning under certain conditions. If, for example, the response the student is required to make is relevant to the material to be learned, then overt responding may facilitate learning. He cites a study done by Holland (1965) which supports this view. Holland studied the effect of type of response, response difficulty and the relevancy of responses to critical material in four versions of 377 frames of the Analysis of Behavior program. His findings indicated that there is an advantage to requiring overt responding when the response is relevant to the material to be learned, and the students are able to make the correct responses. Krumboltz (1964) using an 89 frame linear program on the fundamentals of educational measurement, found that requiring subjects to make trivial responses resulted in significantly worse performance than that obtained for those who read the program, or took the standard program. These

results implied that requiring trivial responses seemed to have the effect of disrupting attention to the critical concepts of the program.

A study by Kemp and Holland (1966) applied the "blackout technique", which involves obliterating words in a program without affecting error rate, to the first fifty frames of twelve programs used in studies of the response mode issue. Four programs which had the lowest blackout ratio (11.1% - 24.5%) were those that showed that constructed reponses led to superior achievement. The programs with the higher blackout ratios (31% - 74.6%) were those which had showed no response mode differences. This seems to provide support for the view that overt responding has a facilitative effect on learning when the responses are, in fact, dependent on the content.

Another condition in which overt responding seems to have a facilitative effect on learning is in programs which require students to learn technical language or foreign vocabulary (Anderson, 1967). This has been demonstrated in studies by Tobias (1969); Tobias and Abramson (1971); and Abramson and Kagen (1975). These studies are similar in that they used programmed materials on heart disease which they administered to university students. One aspect of the instructional materials dealt with information on the incidence and gravity of heart disease in terms understandable by the general public. The other aspect of the program dealt with technical information on the diagnosis of myocardial infarctions. Findings consistently demonstrated that constructed responses on the technical or unfamiliar aspects of the program led to superior student achievement. No differences due to response mode on the familiar material were found.

The Abramson and Kagen (1975) study sought to manipulate student's familiarity with the program content prior to their taking it because no other study in the programmed instruction literature that dealt with different response modes had attempted to do this. Using graduate students as subjects, the investigators used a revised form of the myocardial infarction diagnostic program for the instructional material. They also developed materials on technical terms and electrocardiogram tracings which they used to familiarize a group of subjects prior to exposing them to either a standard or reading format version of the instructional program. Findings indicated that when the instructional material was unfamiliar, constructed responses lead to higher achievement than did reading responses; however, the constructed response groups required significantly more time to complete the program than did the reading response groups. Familiarizing subjects prior to the instructional program and then providing them with the reading mode program resulted in superior achievement. However, requiring familiarized subjects to construct responses led to lower achievement. The investigators suggested that requiring constructed responses to every frame of the material with which the subjects were familiar may have caused a decrease in their attention to the program.

These findings seem to support the view that if a given response is already part of the student's repertoire, or if he is only required to recognize the response, having him read, think, or choose his response from multiple-choice alternatives will probably result in equally effective achievement and more efficiency in terms of the student's time. However, if the student is required to emit an

unfamiliar or technical response, an overt, constructed response should be required.

Earlier studies of response mode indicated that requiring a constructed response to the instructional materials contributed to achievement when the response was relevant to the material to be learned, and the student already had the response in his repertoire (Holland, 1965; Kemp & Holland, 1966). Tobias (1973b) has suggested that the familiarity interpretation, rather than the blackout interpretation, is, theoretically, a more powerful explanation of the discrepancies that were found to exist in these response mode studies, and practically, more easily manipulated and assessed when used as a research variable. Although the evidence has provided support for the familiarity hypothesis in a number of studies (Abramson & Kagen, 1975; Tobias, 1969; Tobias & Abramson, 1971) more study of this variable needs to be carried out with a variety of instructional materials and modes before its effect can be generalized.

Knowledge of correct response. Knowledge of correct response (KCR) has been assumed to have a facilitative effect on learning since the time of Thorndike (Anderson, 1967). Studies, therefore, done using programmed materials which have found no significant differences in achievement due to KCR, expected to be a reinforcer, have been somewhat surprising. Anderson, Kulhavy and Andre (1971) reported on six such studies, and on one which found that a group receiving no KCR resulted in significantly more learning than a group who received 100% KCR. Furthermore, Anderson and his associates cite two studies which are suggestive of KCR functioning more as corrective feedback than as reinforcement.

In an attempt to explain these unanticipated findings, Anderson et al. (1971) have suggested that when immediate KCR is available, students may by-pass important aspects of the instructional materials as they are able to obtain the correct response without paying careful attention to the text. Also, if KCR is accessible to the student prior to his making a response, he may copy the correct response without reading the textual material.

In order to explore the reinforcing and/or feedback function of KCR, and the facilitating function of KCR on achievement when students do not have access to KCR prior to responding to program frames, two experiments were conducted by Anderson et al. (1971). The subjects were educational psychology students who completed Tobias' (1968) modification of a program on the diagnosis of myocardial infarctions. The program was conducted on a computer which ensured that the availability of KCR to subjects could be under the control of the investigators. The findings of these studies indicated that students who received KCR after responding to each program frame learned significantly more than students who received no KCR, or those who had a chance to see the correct response before responding. Providing students with KCR after wrong answers was slightly, but not significantly better than providing them with KCR only after right answers. These results seem to provide support for the hypothesis that KCR is facilitative only when students do not have access to it prior to responding. The function of KCR as primarily reinforcement or corrective feedback is not clear at this time.

The results of the studies reviewed on knowledge of correct response (KCR) would seem to indicate that providing 100 percent KCR to students does have a facilitative effect on achievement when access to KCR is withheld from study subjects until after they have responded to the program frames (Anderson, Kulhavy & Andre, 1971). This interpretation appears plausible when one considers that subjects had access to KCR prior to their responding in many of the studies in which no significant differences in achievement were found due to KCR (Anderson, 1967; Anderson, Kulhavy & Andre, 1971).

Step size. Although step size has been defined in a number of ways, an adequate definition did not seem to be available in the literature reviewed. For example, Markle (1964) defines step as an "indefinite intuitive, but basic concept" and indicates that a step is considered to be too large if a student cannot respond to the item correctly. Step size has been used to refer to the amount of material in a frame which must be read before a response can be made, and has also been defined as the probability of responding correctly as a student proceeds through a program (Taber, Glaser, & Schaefer, 1965). In the literature reviewed, few authors reported an operational definition of step size. In spite of the nonspecificity with which step size has been defined, the evidence available seems to support programs with "short" steps.

Evans, Glaser and Homme (1960) studied the performance of graduate education students who used four versions of programmed materials in mathematics. The programs used contained thirty, forty, fifty-one and sixty-eight steps. Results of the study indicated that

students using the programs of fifty-one and sixty-eight steps made fewer program errors and performed significantly better on immediate and delayed tests of retention. Coulson and Silberman (1960) also found that university students using a small step (104 frames) psychology program performed significantly better and took more time to complete the program than those who used a large step (56 frames) program. A study by Flynn (1969) using programmed materials in psychology with high school students indicated that using small frames each of which elicits a response from students may, in fact, be unnecessary to facilitate learning, and as well, be somewhat inefficient in terms of the time required to complete the program.

Furukawa (1970) made an attempt to match programmed instruction step size with the learning ability of 110 female undergraduate students. The subjects learned Hawaiian words in programmed instruction with step size consisting of one, two, seven, fourteen, or twenty-one chunks. One chunk was one sentence which contained the item to be learned. Findings of the study indicated that small steps led to significantly higher performance. On the posttest, performance was best for subjects who used the seven and fourteen chunk programs. Subjects with low short-term memory scores seemed to perform best with the seven chunk program. The author concluded that these results indicate that step size in programmed instruction does not need to be limited to single sentences or paragraphs.

While some older evidence available seems to support the use of small steps rather than large steps in programmed instruction (Coulson & Silberman, 1960; Evans, Glaser & Homme, 1960), Flynn (1969) has suggested that small steps, each requiring a response,

may not facilitate learning and may not be an efficient use of student time. Furukawa's (1970) study indicated that steps or "chunks" of moderate (7-14) size, significantly improved learning for all subjects; however, subjects with low short-term memory scores seemed to perform best with the seven chunk program. Perhaps these later studies are indicating that there may be an optimal step size for learners of various abilities. However, this sort of evidence is not available at the present time.

Pacing. Pace has been defined as the rate at which a subject is permitted to work through the programmed material (Cook, 1964). Schramm (1964) reported on seven studies concerning individual and external pacing in which no significant differences attributable to type of pacing were found whether students were taught by television, programmed texts or teaching machines.

Allen (1975), in a review, reports a study of pacing in programmed instruction done by Gropper and Kress (1965) in which differentially paced slide material was used with grade eight students. They found that the faster the pace of the presentation, the less learning was achieved by the low mental ability students. Eckhardt (1970) found that time compression of narration and pictorials in a programmed lesson designed to teach Air Force inductees traffic safety had differential effects upon subjects of high and low ability. Compressing the material up to 40 percent did not affect the learning of the high ability group but the learning of the lower ability group was significantly affected by 25 percent compression. Allen (1975) suggests that those of lower ability could profit from slowly-paced

stimuli to compensate for deficient information-processing skills, whereas those of higher ability may prefer a faster pace as they should be able to process stimulus information more rapidly and efficiently.

Although the evidence is, once again, somewhat inconclusive, the studies by Gropper and Kress (1965), and Eckhardt (1970) seem to suggest that lower ability subjects are more adversely affected by fast-paced instructional stimuli than are students of higher ability. For groups of learners of heterogeneous ability, it would seem that self-paced instructional materials may have a facilitative effect on learning by permitting the students to interact with the materials at a rate which is compatible with their learning speed.

Visual elaboration. Nelson, Metzler and Reed (1974) used four sets of stimulus materials with university undergraduates to study the effect of the role of details in long-term recognition of pictures and verbal descriptions. The sets of stimulus materials consisted of black and white photographs; embellished line drawings; unembellished line drawings; and verbal descriptions of each photograph. Findings indicated that both immediate and long term recognition accuracy was significantly higher for all three pictorial conditions than it was for the verbal descriptions. However, the three pictorial conditions were not found to differ significantly from each other.

Ward and Naus (1974) studied the effect of varying the amount of relevant visual stimuli in pictures. Two versions (black line drawings and colored line drawings) of 74 pictures of objects and

animals were shown to four instructional groups consisting of adults and preschool-aged children. Results on a recognition test indicated that when subjects were asked to identify one of two pictures they had previously seen, both adults and children recognized the pictures presented and tested in color significantly faster than they recognized the black and white versions of the same picture. Subjects also recognized the color pictures faster in the testing situation even though during presentation they had been shown the black and white version.

According to McKeachie (1974) increasing the elaborative content of material to be learned does not necessarily have a facilitative effect on learning. Dwyer (1967) studied the effectiveness of showing three types of visual representation of parts of the heart as they were mentioned during an oral presentation to university freshmen. One of the experimental groups saw an abstract linear drawing of the heart and its parts; another was presented with a detailed, shaded drawing; while a third was shown a realistic photographic presentation. Visual materials were not presented to one group which served as a control. Results indicated that the abstract linear, and detailed, shaded visual materials were equally effective and significantly more effective than presenting no visual material with the oral presentation, or presenting the realistic photographic material. Dwyer also found that presenting the realistic photographic visual material was no more effective than the oral presentation alone.

McKeachie (1974) reported on a study by Barrington (1971) which compared a realistic educational television presentation with one with plain, less realistic materials. He used college students as

subjects, and found that the realistic presentation was less effective than the plainer, less realistic presentation.

Dwyer (1973) studied the effectiveness of three methods of presenting visualized instruction, two of which were externally (or group) paced (T.V., and slides) and one which was internally (or student) paced (programmed instruction). Five treatment groups received the same program content which consisted of a 2,000-word unit on the human heart. Group one received the program content but did not receive illustrations of the heart with it. The remaining four groups received visual materials on the heart which differed in elaborative content. Group two received simple line drawings; group three received detailed, shaded drawings; group four was shown photographs of a heart model while group five saw actual photographs of the heart. No mention was made of the visual materials being presented in black and white or color. Following instruction, subjects were given four individual criterial tests (drawing; identification; terminology and comprehension) the scores of which were combined to obtain a total criterial test. Results of the study indicated that no one method of presentation was most effective for the oral, simple line drawing and detailed line drawing treatment groups. The programmed instruction method, however, resulted in significantly higher achievement on the drawing and total criterion test for the group who received the photographs of the heart model. The programmed instruction method also resulted in significantly higher achievement on all five tests for the group receiving the actual photographs of the heart than did the T.V. and slides methods of presentation.

Both Dwyer (1967) and Barrington (1971) found the presentation of plain, less realistic visual material, which accompanied instruction, resulted in more effective achievement than did the use of the more realistic visuals. This may have resulted from the fact that both studies used a group rather than learner-paced presentation. In these two cases, students may have only had enough time to assimilate the information presented in the plain visuals, and may not have had enough time to attend to the relevant cues and the additional information contained in the detailed, more realistic visual materials. This interpretation seems to be supported by the results of Dwyer's (1973) study. In this study, students' performance seemed to indicate that they were able to derive more information from the detailed, as opposed to the simple, visual materials. However, their ability to assimilate the additional information from the more detailed materials, seemed to be related to the time permitted for interaction with them. Interaction with the detailed more realistic visuals seemed to be more effective when presented on a learner (or internally) paced, rather than a group (or externally) paced, basis.

The results of the basic studies by Nelson et al. (1974) and Ward et al. (1974) would seem to provide some direction for the use of visual materials in instructional programs. The study by Nelson et al. (1974) supports the effectiveness of using visual, over verbal, materials in immediate and long-term recognition. The study by Ward et al. (1974) seemed to imply that the use of color, as opposed to black and white, visual materials may also have a facilitative effect on learning.

The results of the applied studies by Barrington (1971) and Dwyer (1967, 1973) seem to suggest that the use of detailed, realistic visuals may facilitate learning more than simple, or plain, visuals if they are presented on a student-paced basis. However, if the presentation is externally paced, students may benefit more from the use of simple, less realistic visual materials.

Component 4: Performance Assessment

Performance assessment is an on-going, goal directed process of collecting and interpreting information on student achievement. The process involves measuring a student's performance both during and following instruction in relation to a specified standard of performance made explicit in the instructional objectives (Davies, Alexander & Yelon, 1974). It provides information about a student's present behavior and the instructional techniques which produced that behavior (Glaser, 1962). Its function is primarily that of providing for a system of instructional quality control (Anderson & Faust, 1974).

Student achievement has traditionally been assessed by the use of norm-referenced measures which describe an individual's performance relative to others. Use of norm-referenced measures provides an indication of the proficiency of one student over another but gives little information about the behavior which an individual is actually capable of performing in relation to the objectives of instruction. Because norm-referenced measures of achievement do not provide specific information about the competencies of individual students in relation to instructional objectives, they are of limited value in providing

direction for the improvement of student achievement and instructional procedures (Glaser, 1962; Popham & Husek, 1971).

Data obtained through the use of criterion-referenced measures, however, does provide specific information about student achievement in relation to the specified enabling and terminal objectives. This information can also be used to assess the adequacy of entering behavior, as well as the appropriateness of the instructional procedures designed to achieve the objectives. The use of criterion-referenced measures for performance assessment, therefore, contributes to student achievement and instructional improvement by providing data upon which decisions regarding remedial instruction and/or modification of one or more aspects of the instructional system can be based (DeCecco, 1974).

Summary

Direct experimental research on learning in school settings and the distillation of propositions about learning and human nature which teachers have tried to apply in classrooms have been the two strategies most commonly used in applying psychological concepts and principles to educational practice. Because the use of these strategies has resulted in research findings which have been largely inconclusive, new strategies, models, or systems for developing effective instruction have been developed. These instructional strategies stress a systematic approach to instructional development and evaluation of each aspect of the system in relation to its effectiveness with learners. Glaser's modified teaching model incorporates the major features of many instructional models, systems

or strategies, e.g., instructional objectives, entering behavior assessment, instructional procedures, and performance assessment; and, therefore, it was selected to guide the development of the experimental instructional program for this study.

As health education is assuming a position of higher priority in the health care system, the demand for demonstrably effective and efficient instructional programs is becoming particularly urgent. It seems, however, that few health professionals have the time, educational knowledge and expertise to develop, implement and evaluate the health education programs which are needed.

The experimental use of programmed instruction in secondary and teritary health education programs has indicated its effectiveness as a teaching tool in the health field; however, it has not, to this author's knowledge, been used in primary health education programs. Since increased attention is, and will continue to be, given to primary health care in the future, educational programs in primary health care will need to be developed. Programmed instruction seems to be a potentially valuable method of increasing the effectiveness of patient learning in primary health education programs while ensuring uniform quality of instruction and decreasing the demands made on health professionals who generally lack adequate knowledge, skills and time for teaching activities. For these reasons, the instructional procedures component of the experimental program developed for this study used a linear, self-instructional approach within the context of Glaser's modified teaching model.

Glaser's modified model, as a conceptualization of the teaching process, was used to guide the development of the experimental instructional program for this study. Instructional objectives were developed and used to plan instructional procedures, assessment procedures, and to formulate overviews to direct the attention of the student to the instructional intent. The process of task analysis was conducted on the instructional objectives in order to identify sequences of en route objectives and optimal conditions for their achievement.

An assessment of entering behavior was conducted to determine the abilities, knowledge, or skills possessed by the student in relation to the objectives prior to beginning the instructional unit. The data obtained from the entering behavior assessment was compared with the posttest data to determine student achievement and, it will be used as a basis for modifying various components of the instructional system in the future.

The instructional procedures used in this study were developed using the instructional objectives specified, and were made available to the student through a self-instructional program. The self-instructional program used was of a linear format and was presented to the students by way of programmed texts. The variables used in the development of the instructional procedures for the experimental program were: sequencing, prompting, responding, knowledge of correct responses, step size, pacing, and visual elaboration. The results of the literature reviewed on these variables, although somewhat inconclusive at the present time, was used to provide direction for the development of the instructional procedures.

Criterion-referenced measures were used to assess the achievement of the students both during and following the instructional unit. The data obtained from these assessments was used for decision-making in relation to the adequacy and need for modification of the various components of the instructional system.

The purpose of this study was to determine empirically if the use of a specific instructional strategy, namely Glaser's modified teaching model, for the development of a linear, self-instructional, primary health education program to teach pregnant women about the characteristics and care of newborns, results in an effective educational product. Stated in a form amenable to statistical testing, it is hypothesized that pregnant women who use the linear, self-instructional program on the characteristics and care of newborns will achieve posttest scores which are significantly higher than those achieved by pregnant women who have not used the instructional program.

It should be emphasized that the purpose of the study was to develop and test an instructional product developed within the framework of Glaser's modified teaching model and Skinner's linear programming techniques. The purpose was not to test empirically the individual components of the model or the programming variables which were used in the development of the instructional procedures component of the model.

CHAPTER II

DESIGN AND PROCEDURE

Subjects

The subjects were 99 pregnant women, at various stages of gestation, who volunteered to participate in the study. The subjects were obtained by calling for volunteers in prenatal education classes sponsored by the four hospitals in Edmonton, by the Edmonton Board of Health, and by the Edmonton Childbirth Association. Additional subjects were obtained by calls for subjects through ITV (the local independent television station), CBC radio (the local radio station of the Canadian Broadcasting Corporation), the Edmonton Journal (the local daily newspaper), and Folio (the University of Alberta Staff Bulletin). Eighty-nine of the subjects had taken a series of prenatal education classes. Ten subjects indicated they had not attended, or were not planning to attend, prenatal classes. Subjects were selected so they would not be exposed to formal classes on the newborn between the pretest and posttest occasions. The experiment was conducted during May and June, 1976. All 99 subjects completed the study requirements.

Materials

The instructional materials used were equivalent forms of a criterion-referenced achievement test and four linear programmed

instruction booklets each with an accompanying set of color slides depicting the characteristics and care of newborn infants. Each booklet and slide set covered one of the following units of content: characteristics; senses and reflexes; crying; and sleeping and elimination. The process used to develop the instructional materials for the study is described under the components of Glaser's modified teaching model (DeCecco & Crawford, 1974).

Component 1: Instructional Objectives

Instructional objectives for the experimental program were developed according to the criteria suggested by Mager (1962). A sample of the objectives is included in Appendix B. The objectives were used primarily as a guide in planning and developing the instructional procedures and assessment components of the teaching model. Explicit statement of the objectives was not provided to the subjects. Instead, the objectives were synthesized and stated in the form of overviews and summaries for segments of the program to direct the subjects' attention to what was to be, and what should have been accomplished in each segment. A sample of an overview and summary is included in Appendix B.

Task analysis. Gagné's system of task analysis was used to analyze the instructional objectives of the experimental program. Specific objectives were classified as representing a category of learned capability. The categories of learned capabilities which the experimental program intended to develop were verbal information, i.e., labels, facts and bodies of knowledge, and the basic intellectual skills of discrimination and concept learning. The conditions of

learning associated with each category of learned capability were identified and subsequently used in planning the instructional procedures component of the teaching model. A sample of the task analysis is included in Appendix B.

Component 2: Entering Behavior

The prerequisite skills which students would require to complete the instructional program were assumed to be a grade eight reading and writing ability. Two equivalent forms of a 50-item, objective type test were developed and the alternate forms of the test were used as a test of entering behavior for all subjects. The tests were primarily directed toward assessing the students' knowledge, ability and skill in relation to the terminal and enabling objectives, and only indirectly did they test the prerequisite skills needed to begin the instructional program. The scores made on the test of entering behavior were recorded so they could be used for comparison with scores obtained on the posttest taken after the instructional program had been completed. The equivalent forms of the test are included in Appendix C.

Anderson and Faust (1974) have suggested that the assessment of entering behavior be used as a basis for designing instructional procedures which take the learner from the level of performance indicated in the entering behavior assessment to the level specified in the terminal objectives. Empirical assessment of entering behavior was not used as a basis for designing instructional procedures for the experimental program because of the constraints of both time and availability of subjects. Linear programming techniques are reported to be effective for learners of heterogeneous abilities. As it was

assumed that subjects would be from a wide range of learning abilities, programming techniques were used as a basis for formulating the instructional procedures component of the teaching model.

Component 3: Instructional Procedures

The instructional procedures component of the experimental program used a set of linear, programmed instructional booklets each with an accompanying set of color slides. The variables, characteristic of programmed instruction, which were used as a basis for formulating the program were sequencing, prompting, responding, knowledge of correct response, step size, pacing and visual elaboration.

Sequencing. In order to select the type of sequence of instruction to be used in developing the experimental program, the ability of the potential subjects, the nature of the learning tasks, and the subjects' prior familiarity with the material to be learned were considered. Since the call for subjects was directed to the general public, it was assumed that the pregnant women in the sample included people of various learning abilities. The result of the task analysis indicated that the tasks to be learned in the program could be classified as verbal information, and the lower levels of the intellectual skills category of learned capabilities (cf. Gagné & Briggs, 1974). Although the material in the program would have been familiar to most subjects, in some cases medical terminology, assumed to be unfamiliar to the general public, was used. For these reasons, a logically-ordered sequence of instruction was selected for use in developing the experimental program (i.e. labels were taught before

facts; facts before bodies of knowledge; bodies of knowledge before discriminations; and discriminations before concepts).

Prompting. Prompts, in the form of underlining, were used to direct the subjects' attention to the discriminative stimuli throughout the program. After a prompt was used, it was withdrawn and unprompted responses were required to ensure that learning had occurred.

Responding. The constructed response format which requires a written answer was used throughout the teaching segments of the program. This format was selected because some of the frames required subjects to emit a technical or unfamiliar response. This response format was also used to encourage subjects' interaction with the content of the program. Having subjects construct responses also provided a record of their responses to be used to determine the error rate of the program and to identify aspects of the program in need of future modification.

Knowledge of correct response. One hundred percent knowledge of correct response was provided to the subjects immediately after responding to the program frames. The program was formatted so that only one frame was printed on a page. The correct response to a frame was printed on the top left corner of the page which followed it. Subjects were directed to respond in writing to each frame before looking at the correct answer. They were informed that by so doing, they would learn more from the program than they would if they looked at the correct answer before responding. The program was printed on green paper to prevent subjects being able to see the correct answer through the page.

Step size. Since the subjects in this study were assumed to have heterogeneous abilities, relatively small steps were used throughout the program in order to obtain a low frequency of program errors. Frames, which contained information about the item to be learned, ranged from one to five sentences in length. The average frame size was two sentences.

Pacing. The instructional program was developed to permit subjects to work through the learning material at their own pace. This enabled them to complete the program on occasions and at speeds which were convenient for them. The amount of time taken to complete each unit of instruction was recorded for all subjects so that the range and average amount of time taken to complete the total instructional program could be determined.

Visual elaboration. The aim of the experimental program was to teach pregnant women what could realistically be expected of the characteristics and care of newborns. Few women, other than those who have had children, and those such as nurses who work with newborns, have had the opportunity to see and handle newborn infants. For this reason, permission was obtained to photograph newborns in the nursery at a large urban teaching hospital. Color transparencies were taken and they were coordinated with the appropriate description in the printed program. Directions for viewing the slides were included in the printed program.

Other visual materials in the form of cartoons and line drawings were included throughout the printed program. These visuals

varied the printed stimulus and were intended as attention maintaining devices.

The instructional procedures for this study were based on the linear programming techniques outlined, and as such, incorporated procedures for motivating the learner and directing attention to the task to be learned, providing a vehicle of instruction, obtaining learner responses, reinforcing correct responses and correcting errors, and, evaluating mastery which Becker et al. (1975) indicated were necessary for an effective instructional system. For example, the program content and visual elaboration, the use of self-pacing, overviews and summaries, logical sequencing, prompting, small program steps, and anecdotal comments were provided to contribute to motivating the learner and directing attention to the learning tasks. Printed linear programmed instruction booklets and color slides were provided to serve as the vehicle of instruction which presented the tasks to be learned, the response requirements, a means for recording student responses, and providing reinforcement and/or corrective feedback. Formative and summative evaluation procedures were also used and will be discussed under the heading of Performance Assessment.

Component 4: Performance Assessment

Written responses to program frames were required so that student progress throughout the program could be assessed. Criterion-referenced objective-type test items (completion, true-false and multiple choice) were included after each section of the units. An eleven item Likert-type scale was included at the end of each unit as a means of obtaining subjects' comments about process and content

aspects of the instructional units. A criterion-referenced achievement test, which sampled items from all four units of instruction was administered after all four units of the program had been completed.

Methods of Measurement

Two equivalent forms of a fifty-item objective-type achievement test on the characteristics and care of newborns were developed. The tests contained fifty declarative statements to which the subjects were to respond using one of three alternative responses (true, false, not sure).

The two forms were pilot tested with ten mothers of young children and four professors. On the basis of their recommendations, some test items were modified. The final forms of the tests are included in Appendix C.

To obtain an estimate of reliability which would provide a measure of stability and equivalence, the tests were administered to a sample of thirty-four student nurses who had no formal experience or instruction in this content area. At the time of initial administration, a table of random numbers was used to assign subjects to one of two groups. Group one received Form A of the achievement test on the first testing occasion and group two received Form B. Four weeks after the initial administration, subjects were retested with the alternate forms of the achievement test.

Design and Analysis

A 3 x 2 factorial design was used to analyze the data. The two independent variables were method of instruction (experimental

treatment, no treatment); and knowledge of newborns and their care (high, medium, low) as measured by the pretest. The dependent variable was knowledge of newborns and their care as measured by an equivalent form of the pretest. Using a table of random numbers, the 99 subjects were randomly assigned to the experimental and control conditions. As a result, 50 women were assigned to the experimental group and 49 were assigned to the control group. The experimental and control group subjects were then randomly assigned to receive Form A or B of the pretest. When subjects were posttested they were given the alternate form of the achievement test they completed during the pretesting occasion.

Procedure

As a result of pilot testing the parallel forms of the achievement test, it was found that approximately 10 - 15 minutes was required for their administration. For this reason, subjects were asked to complete both the personal data form (Appendix D), and one form of the achievement test (Appendix C) after they had completed the last prenatal class in the series they were attending. This was done primarily for the convenience of those subjects who would eventually be assigned to the control group. These subjects would otherwise have had to travel to the university for their first experimental session which would have lasted only 10 - 15 minutes. It was thought that this situation could have reduced the subjects' willingness to return for a subsequent session and thus increased the experimental mortality.

Unfortunately, having all subjects complete the personal data and achievement test forms after the last prenatal class of the series they were attending was not expedient in all cases. In two prenatal classes, having the subjects complete the forms would have been disruptive to the whole class. In these two cases, therefore, the names and phone numbers of interested women were obtained and these subjects were contacted by telephone regarding an appointment to begin the experimental program. These subjects completed the personal data and achievement test forms at the beginning of their first experimental session at the university.

Initially, it was thought that the required number of subjects would be recruited from the prenatal classes attended. It was only after the required number was not obtained that an attempt was made to call for subjects through the mass media. Appointments to begin the experimental program were made with each of the volunteers obtained as a result of the media calls, and these subjects completed the personal data and achievement test forms during their first experimental session at the university.

All subjects were randomly assigned to the experimental or control conditions through the use of a table of random numbers. When subjects entered the experimental room, they were seated at an individual carrel which contained a Singer CARAMATE slide projector.

When the subjects were ready to begin Unit One of the experimental program, the researcher provided them with the instructional materials, set up the slides so they were ready for use and instructed subjects in the operation of the CARAMATE. (See Appendix E for instructions.) If the subjects had any questions, they were answered at this time

and then they proceeded with Unit One of the program.

The directions for use of the printed materials and corresponding slides were included in Unit One. Each set of slides began with a slide identical to the cover of the corresponding unit, i.e., giving the name of the program, and the name and number of the unit. All slides were numbered in the lower right corner of the picture. The subjects were provided with pens and they responded in writing to the frames of the units.

Those subjects in the experimental group who had completed the required forms at the termination of prenatal classes (n = 14) began Unit One of the experimental program during their first experimental session at the University. (See instructions for subjects in Appendix E). These subjects proceeded to complete Units One through Four on a self-paced basis. After completing all four units, the experimental subjects received the alternate form of the achievement test.

The experimental subjects who had not completed the required forms at the termination of their prenatal classes, and the subjects who volunteered as a result of the media calls for subjects (n = 36) completed the personal data and achievement test forms at the beginning of their first experimental session at the university. (See instructions for subjects in Appendix E). These subjects then began Unit One of the experimental program and proceeded through it, and the subsequent three units, on a self-paced basis. Upon completion of all four units, they were posttested with the alternate form of the achievement test.

Those subjects assigned to the control group, who had completed the pretest and personal data forms at the termination of prenatal classes (n = 13), completed the alternate form of the achievement test at the beginning of their first experimental session at the university. They were then started on Unit One of the experimental program and proceeded on a self-paced basis until all four units had been completed. These subjects were not posttested following their completion of Unit Four of the experimental program.

Control group subjects, who had not previously completed the personal data and achievement test forms (n = 36), completed these forms at the beginning of their first experimental session at the university. (See instructions for subjects in Appendix E). After completing the required forms, an appointment was made for these subjects to return for their second session. At the beginning of their second session, these subjects completed the alternate form of the achievement test. Following completion of the achievement test, they began Unit One of the experimental program and proceeded on a self-paced basis through the subsequent three units. These subjects were not tested after completing all four units of the program.

The time interval between the pretest and posttest occasions ranged from one to thirty-three days for the experimental group, and from one to thirty-two days for the control group. The average time interval between the pretest and posttest occasions for both the experimental and the control group was five days.

All subjects in the control group began Unit One of the program after they had completed the posttest. Forty-seven of the forty-nine group subjects subsequently completed all four units of the experimental program.

CHAPTER III

RESULTS AND CONCLUSIONS

The results of the present study are presented and discussed in this chapter in three sections. In the first section, the results of the reliability estimate of the equivalent forms of the achievement tests are reported and discussed. This is followed by a report and a discussion of the data analysis pertaining to the study hypothesis. In the third section, the results of the analysis of the instructional program are presented and discussed.

Reliability of the Achievement Tests

The means and standard deviations for the two forms of the achievement test are presented in Tables 1 and 2. Two, one-way analyses of variance with repeated measures yielded mean square values which were used to calculate reliability estimates of $r = .62$ and $r = .55$ for Groups One and Two respectively. These two estimates were then averaged to obtain one estimate of reliability for the two test forms of $r = .59$.

A less conservative estimate of the reliability of the measures derived from the tests was obtained by calculating a Pearson product-moment correlation coefficient for both groups. This yielded reliability coefficients of $r = .75$ and $r = .59$, for Groups One and Two respectively, which when averaged, provided a reliability coefficient of $r = .67$.

Table 1

Means, Standard Deviations, Analysis of Variance and Reliability Coefficient for Achievement Test Forms A and B for Group One (N = 34)

(a) Means and Standard Deviations

Test Form	Test Occasion	Mean	SD
A	1	19.47	5.564
B	2	22.59	4.839

(b) Analysis of Variance

Source	df	MS	F	P
Between people	16	50.40		
Within People	17	11.79		
Tests	1	82.62	11.21	0.004
Residual	16	7.36		
Total	33			

(c) Reliability Coefficient

$$r = \frac{\text{MS between} - \text{MS within}}{\text{MS between} + \text{MS within}}$$

$$r = \frac{38.61}{62.19} = 0.620$$

Table 2

Means, Standard Deviations, Analysis of Variance and Reliability Coefficient for Achievement Test Forms A and B for Group Two (N = 34)

(a) Means and Standard Deviations

Test Form	Test Occasion	Mean	SD
B	1	23.71	3.690
A	2	22.47	4.871

(b) Analysis of Variance

Source	df	MS	F	P
Between People	16	31.08		
Within People	17	8.91		
Tests	1	12.97	1.50	0.239
Residual	16	8.66		
Total	33			

(c) Reliability Coefficient

$$r = \frac{\text{MS between} - \text{MS within}}{\text{MS between} + \text{MS within}}$$

$$r = \frac{22.17}{39.99} = 0.554$$

An examination of the means and standard deviations of the two forms of the achievement test revealed that both groups of subjects had higher mean scores and lower standard deviations on test Form B than on Form A. These results suggest that Form B was an easier test than Form A. Subjects in Group One, scored significantly higher on Form B when it was administered following Form A. No significant differences were found between the achievement test means of the Forms A and B for Group Two which received test Form B prior to Form A. These results indicate the possibility of a practice effect occurring for subjects taking Form A prior to Form B.

The variability in the scores for Group Two was slightly smaller than that observed for Group One. This may have contributed to the lower estimate of reliability obtained for Group Two, and may have been due to sampling error. This result suggests that, in the future, reliability estimates for these measures should be obtained by administering the test forms to larger groups of women of various ages and ability levels.

An item analysis was conducted on both test forms to estimate the adequacy of the test items. Although the results can provide some indication of the items which may need revision, an analysis of test data obtained from a larger, more heterogeneous sample would provide a more objective basis for judging item adequacy.

According to Gronlund (1971), the nature of the decisions to be made determines the degree of reliability which is considered acceptable. In this present study, the scores on the tests were primarily intended as indicators of subjects' knowledge of program content before and after the instructional program was administered.

Because this study was concerned with group mean differences, and high reliability coefficients are not as essential in making decisions about groups as they are in making decisions about individuals, the estimates of reliability obtained were judged to be acceptable for the purpose of this study.

Although refinement of the achievement tests was beyond the scope of this study, suggestions, based on the present study, can be made for increasing the reliability of the tests for future use. The tests should be administered to larger heterogeneous groups, and the adequacy of the test items should be assessed on the basis of item analyses obtained from these larger samples. Doubling the number of good quality items could provide a more consistent sample of performance. This would add approximately 10 to 15 minutes to the time it would take to complete the test. Finally, if subjects are able to complete the instructional program within a period of one week, as did 42 of the 50 women in the experimental group, imposing a criterion of temporal stability which is less demanding than the four-week interval used would seem to be appropriate, and would contribute to increasing the reliability of the measures.

The Study Hypothesis

The hypothesis of the study predicted that using Glaser's modified teaching model in the development of a linear, self-instructional program to teach pregnant women about the characteristics and care of newborns would result in significantly higher posttest achievement scores for women taking the program than for those who did not take the program. The mean pretest and posttest achievement scores

for the three performance levels of the experimental and control groups are shown in Figure 1. This figure illustrates the effectiveness of the instructional program in increasing the posttest achievement scores of the experimental group.

The results of a two-way analysis of variance Treatment by Performance on posttest achievement scores are shown in Table 3. The analysis resulted in statistically significant main effects for Treatment, F (1, 93) = 659.73, $p<.001$; Performance, F (2, 93) = 17.92, $p<.001$; and their interaction, F (2, 93) = 8.30, $p<.001$. Scheffé comparisons of the means for performance level groups indicated that:

(a) the low performance level group had significantly lower posttest achievement scores than the medium performance level group ($p<.01$);

(b) the low performance level group had significantly lower posttest achievement scores than the high performance level group ($p<.01$); and,

(c) there was no significant difference between the posttest achievement scores obtained by the medium and high performance level groups.

Since the Treatment by Performance interaction was statistically significant, Scheffé comparisons of means were computed. These comparisons indicated that:

(a) there were no significant differences between the posttest achievement scores of each of the three performance level groups in the experimental group;

(b) the posttest achievement scores of the low performance level group in the control group were significantly lower than the

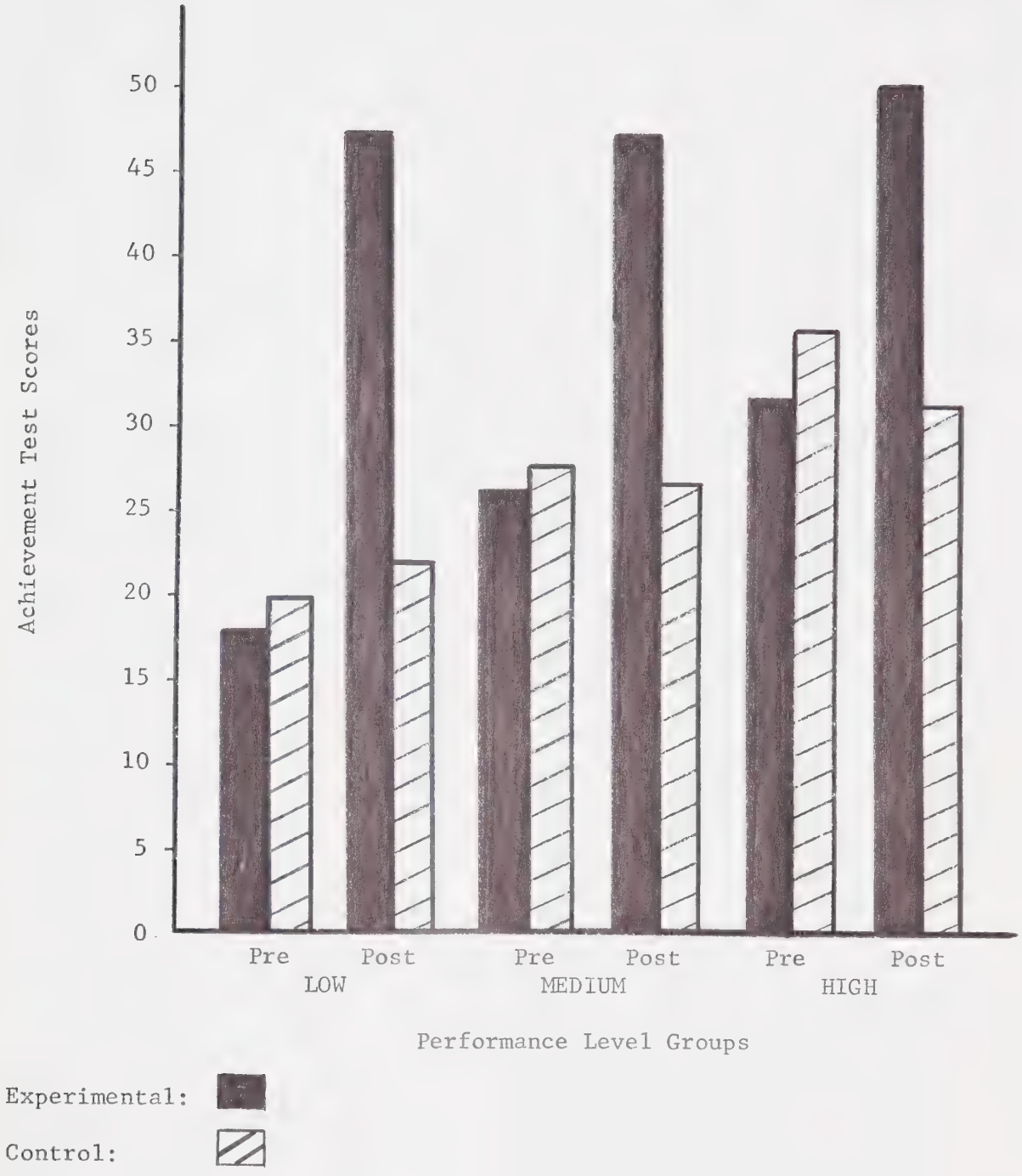

Figure 1

Mean Pretest and Posttest Scores for the Three Performance Level Groups in the Experimental and Control Conditions

(N = 99)

Table 3

Means and Analysis of Variance for Treatment by Performance Level on Achievement Posttest (N = 99)

(a) Mean posttest scores

Treatment Groups	Ability Low	Ability Medium	Ability High	Treatment Means
Experimental	47.28	47.04	49.06	47.75
Control	22.00	27.43	31.78	27.57
Ability Means	34.64	38.33	39.68	37.76

(b) Analysis of Variance

Source	df	MS	F	P
Treatment	1	10.22	659.73	0.001
Ability	2	27.78	17.92	0.001
Treatment x Ability	2	12.86	8.30	0.001
Error	93	15.50		

scores of the medium and high performance level groups in the control group ($p<.01$; $p<.01$); and,

(c) the posttest achievement scores of the medium performance level group in the control group were significantly lower than the posttest achievement scores of the high performance level group in the control group ($p<.01$).

Scheffé comparisons of mean differences between treatment groups and across performance levels indicated:

(a) the differences between the mean posttest achievement scores for the experimental and control groups were significantly greater for the low performance level group than for the high performance level group ($p<.01$); and,

(b) the differences between the mean posttest achievement scores for the experimental and control groups across the low and medium, and medium and high performance level groups were not significantly different.

The results strongly supported the hypothesis that the instructional program would result in significantly higher posttest achievement scores for the experimental group. The difference between the posttest mean scores for the experimental group (96%) and the control group (55%) was highly significant indicating that the instructional program had produced a high level of posttest achievement.

The analysis also indicated that a significant difference existed between performance level groups. This difference was found to exist between the mean posttest achievement scores for the low and medium, and low and high performance level groups. No significant

differences were found to exist between the mean posttest achievement scores of the medium and high performance level groups. The significant differences between the mean posttest achievement scores for the low and medium, and low and high performance level groups supported the decision to include the performance factor for the purpose of increasing sensitivity.

The significant interaction obtained indicated differential program results for the various groups. The instructional program had the effect of eliminating differences between mean posttest achievement scores for the three performance level groups by raising knowledge of program content close to criterion level (95%, 94% and 98%) regardless of the level of entering behavior.

It appears that the interaction of Treatment by Performance occurred because of the differential effect of the treatment groups on performance levels. The treatment effect seemed to vary inversely with performance levels, that is, the differences between the mean posttest achievement scores for the experimental and control groups across performance levels lessened (51%, 39% and 34%) as performance level increased. The difference between the mean posttest achievement scores for the experimental and control groups was greatest for the low performance subjects and least for the high performance subjects. Although differences between the mean posttest achievement scores for the experimental and control groups were observed for medium and high performance level groups, they were not significant.

Although the instructional program was effective in raising each of the performance level groups' knowledge of program content to

a significant degree, the differential treatment effect seemed to indicate that the program was more effective for subjects of low performance than it was for those of medium or high performance. A test ceiling factor could have accounted for this effect because the low performance group had a greater opportunity for improvement on the achievement posttest than did the other performance level groups. This effect indicates that the instructional program was functioning as intended because it enabled subjects of low, medium and high performance levels of entering behavior to reach the criterion.

The Instructional Program

The mean score for the experimental group on the total pretest was 26.38 which represented a correct response rate of 52.76%. The total error rate for the pretest was 47.24%. The means, standard deviations, correct response rates, and error rates for the pretest items pertaining to each unit of the instructional program are presented in Table 4.

The mean score for the experimental group on the total instructional program was 400.24 which represented a correct response rate of 98.58%. The total error rate for the program was 1.42%. The program means, standard deviations, correct response rates and error rates for each of the four instructional units are presented in Table 5.

The mean score on the Likert-type scale, which was used to obtain the subjects' evaluations of the programmed units, was 1.63 for the four units of instruction. The response means and standard deviations for each of the evaluations for the four instructional

Table 4

Mean Achievement Scores, Standard Deviations, Rate of Correct Response and Error Rate for Pretest Items Corresponding to Program Units

(N = 50)

Unit	Possible Score	Mean	SD	Rate of Correct Response	Error Rate
1	22	12.18	3.19	55.36%	44.64%
2	10	5.26	1.65	52.60%	47.40%
3	10	5.46	1.72	54.60%	45.40%
4	8	3.48	1.64	43.50%	56.50%
Total	50	26.38	6.38	52.76%	47.24%

Table 5

Mean Achievement Scores, Standard Deviations, Rate of Correct Response and Error Rate on Program Units

(N = 50)

Unit	Possible Score	Mean	SD	Rate of Correct Response	Error Rate
1	145	142.92	1.74	98.56%	1.44%
2	93	91.78	1.19	98.67%	1.33%
3	93	91.90	1.08	98.81%	1.19%
4	75	73.64	1.67	98.18%	1.82%
Total	406	400.24	4.18	98.58%	1.42%

units are presented in Table 6.

The time taken by the experimental group to complete all four instructional units ranged from one hour and forty minutes to four hours and twenty-five minutes. The mean time for completion was two hours and twenty-eight minutes. The time means, standard deviations and ranges for each of the four instructional units are presented in Table 7.

The mean score for the experimental group on the total posttest was 47.76 which represented a correct response rate of 95.52%. The total error rate on the posttest was 4.48%. The posttest means, standard deviations, correct response rates and error rates for the posttest items pertaining to each unit of the instructional program are presented in Table 8.

All aspects of the total instructional program, the pretest, the programmed units and the posttest were designed to be criterion referenced. Specifically, the pretest was intended to be a test of entering behavior which measured the subjects' knowledge of the program content prior to their using the programmed units. The scores on the pretest indicated that subjects' knowledge in relation to the program objectives was varied, and as a result, it was categorized as low, medium and high for the purpose of increasing the sensitivity of the analysis.

The four programmed units were designed to take subjects from various levels of entering behavior to the criterion while making a minimal number of program errors. One hundred percent knowledge of correct response was used to reinforce correct responses and to provide corrective feedback for incorrect responses. The total program

Table 6

Means and Standard Deviations for Unit Evaluations

Item	Unit 1		Unit 2		Unit 3		Unit 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1. The written materials were easy to follow.	1.28	.45	1.32	.51	1.42	.49	1.40	.49
*2. The slides did little to increase my understanding of the information presented.	1.32	.47	1.64	.69	1.90	.67	1.64	.62
3. The slides and the written materials were well coordinated.	1.48	.50	1.62	.60	1.68	.51	1.56	.50
4. Working at my own rate was enjoyable.	1.40	.49	1.44	.54	1.54	.50	1.48	.50
*5. Writing out the answers was a waste of time.	1.72	.60	1.80	.60	1.78	.58	1.74	.59
*6. Having access to the correct answers made little difference to me.	1.82	.55	2.06	.79	2.16	.95	2.10	.92
7. The content presented in the unit was interesting.	1.36	.52	1.50	.54	1.44	.50	1.54	.50
*8. The unit did little to increase my understanding of newborns.	1.38	.52	1.56	.57	1.48	.54	1.40	.53
9. The material I learned in this unit helped my understanding of what can be expected of newborns.	1.32	.47	1.48	.54	1.50	.54	1.40	.49
*10. This unit contained too much unnecessary information.	1.46	.54	1.64	.66	1.60	.53	1.60	.49
11. More information could have been presented in this unit.	3.40	.94	3.36	.89	3.48	.73	3.66	.79

*Negative items were reversed so that scores could be easily interpreted.

Table 7

Means, Standard Deviations and Range of Time in Minutes for Completion of Program Units

(N = 50)

Unit	Mean	SD	Range
1	63.70	12.92	45-120
2	31.14	7.73	20- 70
3	29.90	6.75	20- 45
4	24.0	5.39	15- 40
Total	148.74	28.34	100-265

Table 8

Mean Achievement Scores, Standard Deviations, Rate of Correct Response and Error Rate for Posttest Items Corresponding to Program Units

(N = 50)

Unit	Possible Score	Mean	SD	Rate of Correct Response	Error
1	22	20.68	1.30	94.00%	6.00%
2	10	9.62	.63	96.20%	3.80%
3	10	9.66	.65	96.60%	3.40%
4	8	7.80	.40	97.50%	2.50%
Total	50	47.76	2.22	95.52%	4.48%

error rate (1.42%) was well below the ten percent considered to be the conventional standard for program revision (DeCecco & Crawford, 1974). In a program in which the KCR is accessible to the subjects, as it was in this study, it is difficult to determine whether the error rate obtained accurately reflected the errors made on the program because subjects could have looked at the answers prior to recording their responses. If they did look at the answers before recording their responses, their high scores on the achievement posttest did not indicate that it detracted from attention to the program content.

An item analysis of the instructional units indicated that a number of program frames elicited high error rates. Four frames in Unit One, five frames in Unit Two and one frame in Unit Four elicited incorrect responses from ten to thirty-six percent of the subjects. The error rate for each frame in Unit Three was under the ten percent criterion. The high error rates obtained on the faulty frames of Units One, Two and Four indicated a need for their revision in the future.

Subjects' evaluations of the instructional units were very positive toward ten of the eleven aspects which they were asked to assess. Responses to item eleven indicated that subjects generally were neutral, or disagreed, with the statement that more content could have been presented in the unit. The positive evaluations and the zero attrition rate of the subjects suggests that the use of a programmed approach to instruction was found to be both interesting and motivating.

The time taken to complete the program also seemed to reflect individual differences in the learning speeds of the subjects. The

self-paced aspect of the program seemed to enable subjects to interact with the instructional materials for an amount of time they wanted or needed to learn the program content. Permitting them the time they wished to interact with the materials may have contributed to the amount learned and to maintaining interest in the instructional materials.

Mean scores on the achievement posttest indicated that the programmed units were effective in raising subjects' knowledge of program content 85.52% between the pretest and posttest occasions. All subjects worked through, and were posttested on the units in the same order. For this reason, the serial position effect (Kintsch, 1970) may have been expected to appear in recall of program content. The mean posttest achievement score for Unit Four was significantly higher than the mean posttest achievement scores for Units One, Two, and Three ($p<.001$). Although the mean posttest achievement scores for Units Two and Three did not differ significantly from each other, they were significantly higher than the mean posttest achievement scores for Unit One ($p<.001$). These results are not suggestive of a serial position effect, however, they do indicate a slight recency effect. Although some of the differences between the achievement means for subsections of the posttest were found to be statistically significant, the high degree of learning which occurred in each of the four instructional units indicated that these differences were not substantial.

A correlational analysis was conducted to examine the nature of relationships which existed between the totals and subsection scores of the pretest, posttest, programmed units, and the time taken to

complete the units. Because the program was criterion referenced, and designed to take subjects from various levels of entering behavior to criterion on an individually-paced basis, high correlations between the pretest, posttest, programmed units and time scores were not expected. The correlational analysis, although not justifiable conceptually because of the confounding factor of time, confirmed this expectation.

CHAPTER IV

DISCUSSION

This chapter describes the implications of the results of the study for educational research and practice. The limitations of the conclusions are presented and suggestions for future research are given.

Implications for Education

There have been two major strategies used in the past to apply psychological concepts and principles to educational practice. The first strategy involved direct experimental research on learning in school settings, and the second represented attempts to distill sets of propositions from basic research which teachers tried to apply in classrooms. Both strategies have resulted in findings which have been largely inconclusive. Studies which have attempted to compare the effectiveness of two or more teaching methods, when the individual effectiveness of the methods being compared had never been determined, and the reduced capacity of psychology to predict which methods and materials would result in maximized learning have been offered as the two major reasons for the inconclusive results obtained (Anderson & Faust, 1974).

The present study has been an attempt to provide support for the use of a specific instructional strategy for the development of a linear, self-instructional program to teach pregnant women about the

characteristics and care of newborns. The instructional strategy used in this study was Glaser's modified teaching model, and Skinner's linear programming techniques were used in developing the instructional procedures component of the model. The results of the study indicated that the instructional program developed was an effective educational product in that it resulted in a significant increase in achievement, and increased subjects' knowledge of the program content close to the criterion, regardless of their level of entering behavior. These results support the argument advanced by several researchers (Anderson, 1967, 1969; Glaser, 1964; and Tiemann, Padden & McIntyre, 1966) that the use of a systematic instructional process, or strategy, which incorporates instructional objectives, entering behavior assessment, instructional procedures and performance assessment, and evaluates each aspect in relation to its effectiveness with learners usually results in effective instruction. Moreover, the results also suggest that Glaser's modified instructional model was an appropriate framework within which psychological concepts and principles (for example, Gagné's task analysis, and Skinner's programming techniques) can be applied in order to improve educational practice.

The instructional materials developed cater to individual differences in learning rate and, since they are self-contained, they could be made available and used by the general public whenever interest in learning the program content is expressed. The materials could be used as an alternative for those who are unable, or do not wish, to use existing health education programs. Materials such as these would seem to be particularly appropriate, for example, for use

in rural areas where health education services may not be readily available. The zero attrition rate and the enthusiastic response of the subjects toward using the instructional materials suggests that self-instructional programs in teaching pregnant women about newborns can be highly motivating.

Use of this approach in primary health education could also result in a saving of time, and health care dollars, by freeing health professionals from repetitious teaching in one-to-one situations while maintaining uniform standards of instruction. Although the resources required to initially develop the materials are substantial, their ultimate dissemination and use could result in an even greater saving of educational and health care resources while making a substantial contribution to raising the health status of individuals and their families.

Limitations of the Study

The major limitation that should be considered in interpreting the results of the study concerns the selection of the sample. The subjects were volunteers from within a twenty-five mile radius of Edmonton. It is not unreasonable to assume that the subjects who volunteered to use the instructional program may have been a very highly motivated group, particularly when using the program involved making a number of trips to the University. It can be argued, however, that since the program is intended for use by the general pregnant population, on a strictly voluntary basis, only those persons who want to learn the program content will be interested in using it.

The second limitation that should be considered is that little control over the period of time between the pretest and posttest occasions was possible. Since the subjects were obtained through many different sources, it was not possible to pretest them at the same time or in the same setting. Furthermore, since the program used a self-paced approach, one, two, three or four of the instructional units could have been, and were completed during one experimental session.

Suggestions for Future Research

The present study should be replicated after a number of revisions have been made in the instructional materials. In particular, the equivalent forms of the achievement test need modification to increase their reliability. As well, the program items, which elicited a ten to thirty-six percent error rate, need revision to reduce the error rate below the ten percent criterion.

It also seems to be relevant to develop a follow-up measure of program content retention which could be administered to women following the birth of their infants. It may also be feasible to develop an indicator which could be used to assess the extent to which the women actually use the material learned in the program. A further suggestion for future research is to obtain, or develop, an affective measure which could be used to determine the effect of the program on the emotional responses of women assuming responsibility for the care of a newborn within the first few weeks following the infant's birth.

The instructional materials, after modification, should be studied using both expectant fathers as well as mothers as subjects. A number of expectant fathers indicated a desire to use the instructional program, but due to the expense of the additional materials that would be needed, they could not be accommodated in the present study. It would be interesting to determine whether there is any difference, i.e., in terms of cognitive and/or affective responses, between providing the materials only to pregnant women, and providing them to both expectant parents.

One final recommendation for future research concerns the setting in which the instructional program could be used. It seems that the effectiveness of the materials should be studied in various settings, for example, in physicians' offices, clinics, and hospitals in both urban and rural settings. These settings would be more accessible and familiar to women seeking prenatal care than the University setting in which the present study was conducted.

CHAPTER V

SUMMARY

The purpose of the present study was to determine empirically if using Glaser's modified teaching model for the development of a linear, self-instructional primary health eduation program to teach pregnant women about the characteristics and care of newborns, resulted in an effective educational product.

The two strategies most commonly used in applying psychological concepts and principles to education, namely, direct experimental study of learning in schools, and the distillation of propositions about learning and human nature from basic research which teachers have tried to apply in classrooms, have resulted in findings which are largely inconclusive. Failure to determine empirically the effectiveness of individual teaching methods prior to comparing them, as well as the reduced capacity of psychology to predict the effectiveness of instructional materials before they are actually tried, are the major explanations advanced for the inconclusive results of studies which have used these two strategies.

The problems experienced, and the inconclusive results obtained when these two strategies have been used have resulted in the formulation of new conceptualizations of the teaching process. These instructional models, or strategies, commonly use a systematic approach in the development of four basic components of the models:

instructional objectives, entering behavior assessment, instructional procedures and performance assessment. Very little consideration has been given to using an instructional model as the basis for the development of instructional programs in the area of health education. Moreover, programmed instruction techniques, used within the framework of an instructional model have not been used, to the present author's knowledge, in primary health education.

Ninety-nine pregnant women were randomly assigned to one of two groups (experimental and control) and were pretested. Based on the scores obtained on the pretest, the subjects were divided into three performance groups (high, medium and low). All subjects in the experimental group received an instructional program on the care and characteristics of newborns which consisted of four programmed instruction booklets and accompanying sets of color slides. When the instructional program had been completed, the experimental subjects were posttested. The subjects in the control group received no treatment between the pretest and posttest occasions. The average time interval between the pretest and posttest occasions for both the experimental and control groups was five days.

The results indicated that the instructional program was highly effective. It had the effect of raising the subjects' level of content knowledge to criterion regardless of their level of entering behavior. The findings of the study indicated that the use of Glaser's modified teaching model for the development of a linear, self-instructional primary health education program resulted in an effective instructional product. Subjects' responses to the instructional program were strongly positive. This combined with a

zero attrition rate indicated that the use of this type of approach in a specific primary health education program can be highly motivating.

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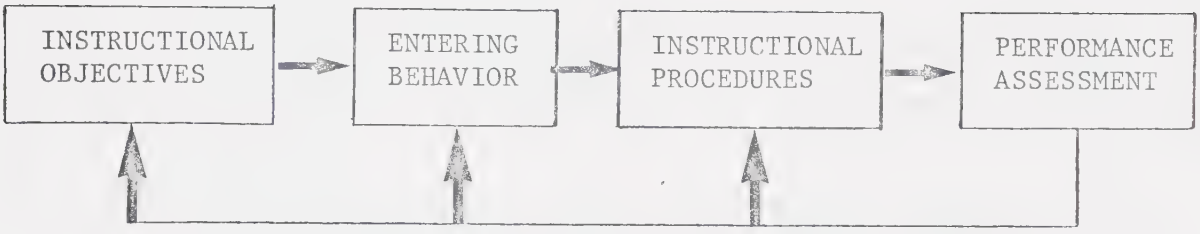
APPENDICES

APPENDIX A

TEACHING MODELS

A Basic Teaching Model*



*After Glaser, R., 1962. In DeCecco, J. P., & Crawford, W. R. The psychology of learning and instruction (2nd ed.). Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1974.

A Practical Strategy for Developing Effective Instruction*

1. Prepare a very clear, detailed statement of objectives.

2. Analyze the skills and knowledge a student will need to attain the objectives.

3. Determine the skills and knowledge students already possess.

4. Devise or select instructional materials and techniques to teach the concepts and skills identified in the task analysis.

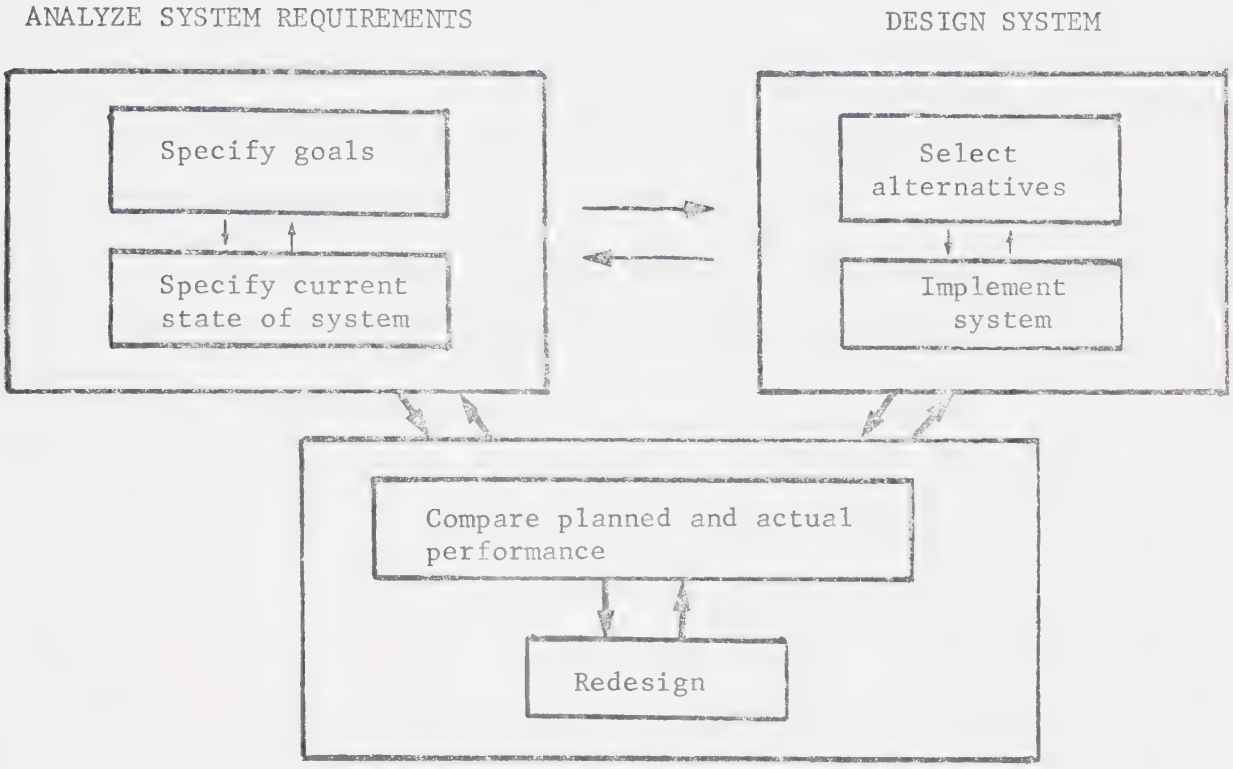
5. Teach.

6. After teaching has begun, systematically evaluate student performance to determine whether all students have attained each objective.

7. If students fail to master objectives on the first try, re-teach them, reviewing the foregoing steps and revising the instruction so that it will teach better when next used.

*Anderson, Richard C. & Faust, Gerald W. Educational psychology: the science of instruction and learning. Toronto: Dodd, Mead and Company, 1974.

The Strategy of Learning System Design*



*Davis, Robert H., Alexander, Lawrence T. & Yelon, Stephen L. Learning system design an approach to the improvement of instruction. Toronto: McGraw-Hill Book Company, 1974.

Steps in Instructional System Development*

1. Analysis and identification of needs
2. Definition of goals and objectives
3. Identification of alternative ways to meet needs
4. Design of system components
5. Analysis of (a) resources required, (b) resources available, (c) constraints
6. Action to remove or modify constraints
7. Selection or development of instructional materials
8. Design of student assessment procedures
9. Field testing; formative evaluation and teacher training
10. Adjustments, revisions, and further evaluation
11. Summative evaluation
12. Operational installation

*Gagne, Robert M. & Briggs, Leslie J. Principles of instructional design. Toronto: Holt, Rinehart and Winston, Inc., 1974.

APPENDIX B

SAMPLES OF INSTRUCTIONAL MATERIALS

INSTRUCTIONAL OBJECTIVES

Unit Three: Crying

1. Given statements, on a true-false quiz, which state the most commonly accepted meaning of crying in the newborn, the student can correctly determine whether the statements are true or false.

2. Given statements, on a true-false quiz, which describe the amount of time a newborn can be expected to cry during the first few weeks of life, the student can correctly identify whether the statements are true or false.

3. Given statements, on a true-false quiz, which state the most common cause of crying in the newborn, the student can correctly identify whether the statements are true or false.

4. Given statements, on a true-false quiz, which describe one or more of eight possible factors which cause crying in the newborn, the student can correctly identify whether the statements are true or false.

5. Given statements, on a true-false quiz, which describe a women's ability to interpret the cause of crying in the newborn, the student can correctly identify whether the statements are true or false.

6. Given statements, on a true-false quiz, which describe crying due to a specific cause, the student can correctly identify whether the indicators stated to be associated with the cause of crying are true or false.

7. Given statements, on a true-false quiz, which describe actions which can prevent or stop crying due to one of the eight specific causes of crying in the newborn, the student will correctly identify whether the statements are true or false.

8. Given statements, on a true-false quiz, which describe the feelings commonly experienced by mothers whose newborns cry for prolonged periods of time, the student will correctly identify whether the statements are true or false.

9. Given statements, on a true-false quiz, which state the time and/or the behavior of the newborn which can be expected to occur when crying starts to diminish, the student can correctly identify whether the statements are true or false.

OVERVIEW AND SUMMARY

Unit Three: Crying

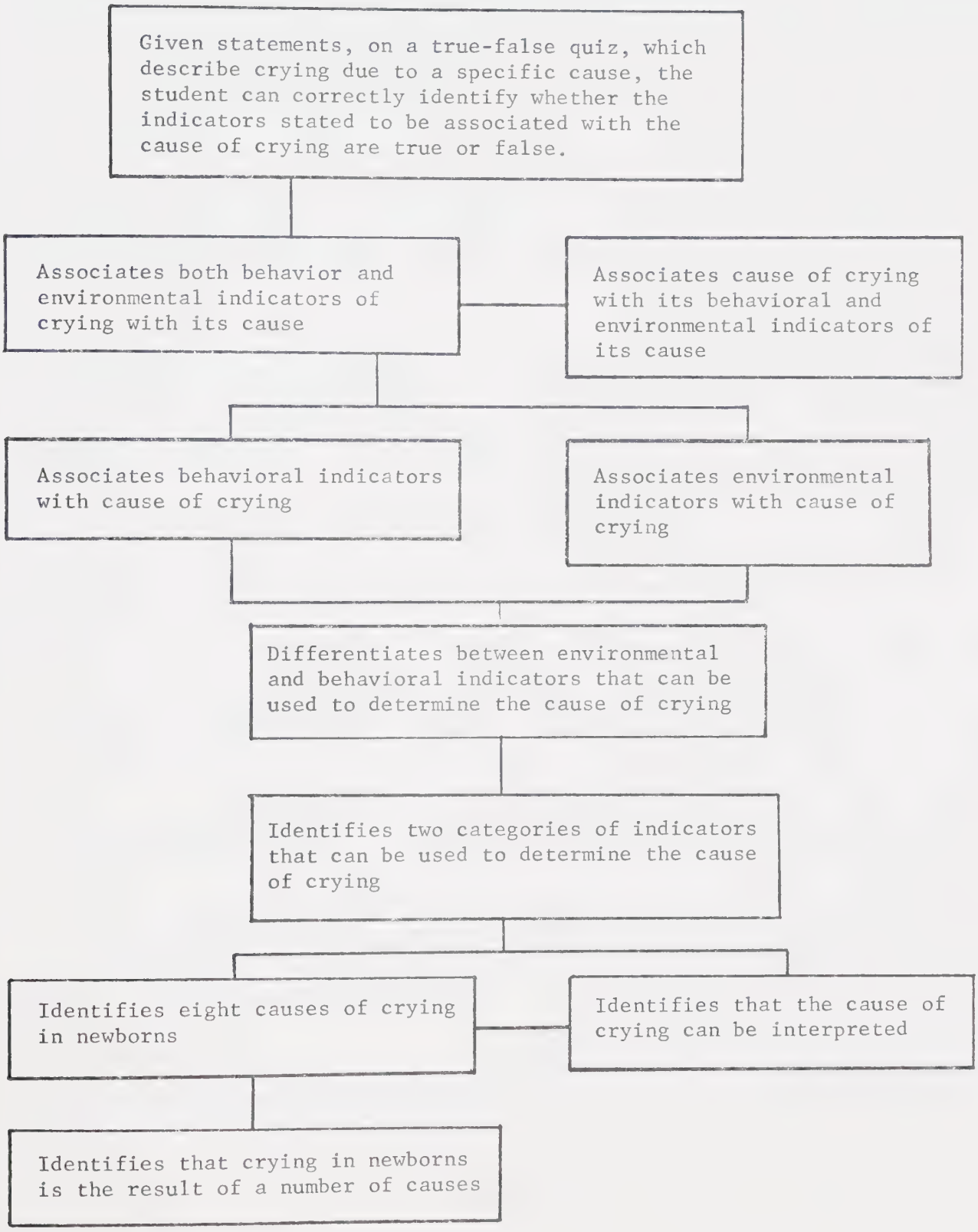
Overview

This unit describes the crying behavior of newborns. It covers the meaning of crying, the amount of crying that can be expected, the causes of crying, and suggestions for preventing or halting crying in the newborn.

Summary

You have now covered the material on crying in the newborn. You should have learned about the meaning of crying, the amount of crying that can be expected, and the causes of crying in the newborn. You should also be "armed" with some hints as to what you can do to prevent or halt crying in your newborn.

TASK ANALYSIS



APPENDIX C

ACHIEVEMENT TEST FORMS

FORM A

NEWBORNS AND THEIR CARE

The purpose of this test is to find out how much women know, or do not know, about newborns and their care. The information obtained from this test will provide direction for the development of instructional programs on newborns and their care which will be used to teach pregnant women in the future. For this reason, you should answer all of the test items as honestly as possible. All of your answers will be kept confidential.

WRITE YOUR NAME HERE_____

INSTRUCTIONS: The test is made up of 50 items which describe newborns and their care. There are three possible responses to each item. You will be asked to indicate whether you think each item is TRUE, FALSE, or whether you are NOT SURE.

Read the following SAMPLE ITEMS and MARK your responses in the box provided alongside each item. Place an X in the left-hand box if your answer choice is TRUE, in the middle box if your answer choice is FALSE, or in the right-hand box if your answer choice is NOT SURE. READ each item CAREFULLY and mark only ONE response to each item.

SAMPLE ITEMS:

	TRUE	FALSE	NOT SURE
1. Nausea can be expected to occur during the first three months of pregnancy.	☐	☐	☐
2. The decision to breast or bottle feed the newborn must be made during the fifth month of pregnancy.	☐	☐	☐
3. Most pregnant women in Canada give birth to their babies in hospitals.	☐	☐	☐

The correct answers to the sample items are: (1) TRUE; (2) FALSE; and (3) TRUE. If you were NOT SURE whether the items were TRUE or FALSE, you should have recorded NOT SURE as your response.

If any of the instructions are not clear to you, please ask questions before beginning the test. You may take as much time as you need to complete the test. There is no time limit.

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		TRUE	FALSE	NOT SURE	For Office Use Only	
1.	It can be expected that the newborn will lose weight during the first three days of life.	☐	☐	☐	___	6
2.	At birth, the newborn's skin can be expected to be pink and smooth.	☐	☐	☐	___	7
3.	The head of the newborn can be expected to be misshapen at birth.	☐	☐	☐	___	8
4.	The nose of the newborn can be expected to look flattened at birth.	☐	☐	☐	___	9
5.	Tears can be expected when the newborn cries.	☐	☐	☐	___	10
6.	Crossing of the eyes in the newborn is usually a sign that the eye muscles have been damaged during the birth process.	☐	☐	☐	___	11
7.	Swollen breasts in a male newborn are considered to be abnormal.	☐	☐	☐	___	12
8.	The foreskin cannot be pulled back over the tip of newborn's penis.	☐	☐	☐	___	13
9.	Vernix dries the skin of the newborn and causes peeling.	☐	☐	☐	___	14
10.	Molding describes the change in the shape of the newborn's head which occurs during the birth process.	☐	☐	☐	___	15

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		TRUE	FALSE	NOT SURE	For Office Use Only	
11.	The cause of "newborn rash" is unknown.	☐	☐	☐	___	16
12.	A build up of secretions from the oil glands cause milia to be present on the newborn's face.	☐	☐	☐	___	17
13.	Commercially prepared eyedrops should be placed in the eyes of the newborn at least once a day during the first two weeks of life.	☐	☐	☐	___	18
14.	The fontanels are covered with a tough, leather-like membrane.	☐	☐	☐	___	19
15.	The shape of the newborn's head is not affected by the position in which he sleeps.	☐	☐	☐	___	20
16.	A slightly bloody vaginal discharge is considered normal in the newborn.	☐	☐	☐	___	21
17.	If jaundice is noticed in the five-day-old newborn, it should be reported to the doctor immediately.	☐	☐	☐	___	22
18.	Sponge baths should be given to the newborn until the cord area is completely healed.	☐	☐	☐	___	23
19.	It will take approximately four to five months for the fontanel on the top of the newborn's head to close over.	☐	☐	☐	___	24
20.	"Storkbites" are permanent birthmarks.	☐	☐	☐	___	25
21.	The umbilical cord will turn black before it falls off.	☐	☐	☐	___	26

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		TRUE	FALSE	NOT SURE	For Office Use Only	
22.	Babies born with bowed legs usually have to undergo corrective treatment before one year of age.	☐	☐	☐	___	27
23.	Of all the senses of the newborn, hearing is the most highly developed at birth.	☐	☐	☐	___	28
24.	The visual ability of the newborn is similar to that of any child or adult.	☐	☐	☐	___	29
25.	The newborn responds to sounds such as voices and music.	☐	☐	☐	___	30
26.	The newborn likes to look at the human face and bright colors.	☐	☐	☐	___	31
27.	The newborn will not respond to being touched on the cheek.	☐	☐	☐	___	32
28.	The newborn whose nose is blocked with mucous can clear it by sneezing.	☐	☐	☐	___	33
29.	Sudden movements which surprise the newborn will elicit the Moro reflex.	☐	☐	☐	___	34
30.	If the newborn is placed on his stomach, he will usually lie quietly without moving.	☐	☐	☐	___	35
31.	The easiest way to get the newborn to open his mouth to grasp the nipple is to press down on his chin.	☐	☐	☐	___	36
32.	It is considered safe to momentarily leave a newborn lying on a table or counter top as long as you can keep an eye on him.	☐	☐	☐	___	37

37

		TRUE	FALSE	NOT SURE	For Office Use Only	
33.	Crying in the newborn is a sign that he wants or needs something.	☐	☐	☐	___	38
34.	Newborns can be expected to cry an average of two hours per day.	☐	☐	☐	___	39
35.	A wet or soiled diaper is the most common cause of crying in the newborn during the first few weeks of life.	☐	☐	☐	___	40
36.	A common reason for crying in newborns is that they miss physical contact with their mothers.	☐	☐	☐	___	41
37.	Mothers learn to interpret the meaning of their newborn's cries.	☐	☐	☐	___	42
38.	Stomach discomfort in the newborn usually elicits the gag reflex.	☐	☐	☐	___	43
39.	Cuddling and rocking the newborn will "spoil" him.	☐	☐	☐	___	44
40.	Wrapping the naked newborn's chest and stomach with a towel or blanket will stop crying which is due to exposure.	☐	☐	☐	___	45
41.	Mothers generally feel inadequate if, in spite of their efforts to comfort their crying newborns, the babies continue to cry.	☐	☐	☐	___	46
42.	Crying will start to diminish when the newborn is around one month old.	☐	☐	☐	___	47
43.	The newborn can be expected to sleep an average of fifteen hours per day.	☐	☐	☐	___	48

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		TRUE	FALSE	NOT SURE	For Office Use Only	
44.	It is considered safe to use a pillow as a mattress in a bassinette.	☐	☐	☐	___	49
45.	Positioning the newborn on his back is considered to be a safe position for sleep.	☐	☐	☐	___	50
46.	During the first two to three days of life, the bowel movements of the newborn are expected to be black or greenish-black.	☐	☐	☐	___	51
47.	The stools of the bottle-fed newborn are golden yellow and have a pasty consistency.	☐	☐	☐	___	52
48.	Constipation rarely occurs in the newborn.	☐	☐	☐	___	53
49.	The best sign of diarrhea or constipation in the newborn is the number of stools which are passed per day.	☐	☐	☐	___	54
50.	Because newborns don't wait until their bladders are full before urinating, they may always seem to be wet.	☐	☐	☐	___	55

NEWBORNS AND THEIR CARE

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SAMPLE ITEMS:

	TRUE	FALSE	NOT SURE
1. Nausea can be expected to occur during the first three months of pregnancy.	☐	☐	☐
2. The decision to breast or bottle feed the newborn must be made during the fifth month of pregnancy.	☐	☐	☐
3. Most pregnant women in Canada give birth to their babies in hospitals.	☐	☐	☐

The correct answers to the sample items are: (1) TRUE; (2) FALSE; and (3) TRUE. If you were NOT SURE whether the items were TRUE or FALSE, you should have recorded NOT SURE as your response.

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	TRUE	FALSE	NOT SURE	For Office Use Only
1. It can be expected that the newborn will gain approximately two ounces a day during the first three days of life.	☐	☐	☐	___ 6
2. The newborn's skin can be expected to be red and wrinkled at birth.	☐	☐	☐	___ 7
3. At birth, the head of the newborn can be expected to be small and round.	☐	☐	☐	___ 8
4. A flattened nose in the newborn is usually a sign of a birth injury.	☐	☐	☐	___ 9
5. The crying of the newborn is tearless.	☐	☐	☐	___ 10
6. Since eye movements in the newborn are not coordinated, he may, at times, look cross-eyed.	☐	☐	☐	___ 11
7. Both male and female newborns can be expected to have swollen breasts during the first week of life.	☐	☐	☐	___ 12
8. The newborn whose foreskin cannot be pulled back over the tip of the penis should be circumcised.	☐	☐	☐	___ 13
9. Vernix protects the skin of the newborn before birth.	☐	☐	☐	___ 14

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	TRUE	FALSE	NOT SURE	For Office Use Only	
10. Molding is caused by pressure on the newborn's head during the birth process.	☐	☐	☐	___	15
11. "Newborn rash" is caused by a vaginal infection in the mother which is transmitted to the newborn during the birth process.	☐	☐	☐	___	16
12. The cause of milia in the newborn is unknown.	☐	☐	☐	___	17
13. Eye care in the newborn should consist of wiping from the inner to outer corner of the eye with a clean cloth moistened with clear water.	☐	☐	☐	___	18
14. Touching or rubbing the fontanels will hurt the newborn's head.	☐	☐	☐	___	19
15. The newborn's head may become flattened on one side if he is always placed in the same position for sleeping.	☐	☐	☐	___	20
16. A slightly bloody discharge on a female newborn's diaper is abnormal and should be reported to the doctor immediately.	☐	☐	☐	___	21
17. Jaundice in the five-day-old newborn is considered to be normal.	☐	☐	☐	___	22
18. Tub baths should be started as soon as the newborn is taken home from the hospital.	☐	☐	☐	___	23
19. The fontanel on the top of the newborn's head can be expected to close over when the baby is between 1 and 1½ years of age.	☐	☐	☐	___	24

	TRUE	FALSE	NOT SURE	For Office Use Only
20. "Storkbites" that may be present on the newborn's face will disappear if rubbed with a mild cream or lotion.	☐	☐	☐	___ 25
21. The umbilical cord will fall off by the time the newborn is two to three weeks old.	☐	☐	☐	___ 26
22. Bowed legs in the newborn usually straighten out by themselves without special care.	☐	☐	☐	___ 27
23. At birth, touch is the most highly developed of the newborn's senses.	☐	☐	☐	___ 28
24. The newborn can see light, dark, and color at birth.	☐	☐	☐	___ 29
25. The newborn is unable to hear well until he is approximately two weeks old.	☐	☐	☐	___ 30
26. The newborn likes to look at a mobile which is hung approximately 15 inches above his head.	☐	☐	☐	___ 31
27. If the newborn is touched on the cheek, he will turn his head toward the touch and open his mouth.	☐	☐	☐	___ 32
28. If the newborn's nose is blocked with mucous, it must be removed by an adult or his breathing will be impaired.	☐	☐	☐	___ 33
29. The newborn is generally unresponsive to sudden movements which jar his position.	☐	☐	☐	___ 34

		TRUE	FALSE	NOT SURE	For Office Use Only	
30.	If the newborn is placed on his stomach, he will make crawling movements.	☐	☐	☐	___	35
31.	To have the newborn open his mouth to grasp the nipple, you should press his cheeks together.	☐	☐	☐	___	36
32.	When bathing or changing the newborn, you should always keep one hand on him.	☐	☐	☐	___	37
33.	Crying in the newborn is usually a sign that he is spoiled and is trying to get his own way.	☐	☐	☐	___	38
34.	Newborns generally can be expected to cry very little during the first few weeks of life.	☐	☐	☐	___	39
35.	In the first few weeks of life, hunger is the most usual cause of crying in the newborn.	☐	☐	☐	___	40
36.	Crying which seems to be causeless may be due to the newborn's lack of physical contact with his mother.	☐	☐	☐	___	41
37.	The sounds of a newborn's cries, and his behavior when crying, will provide a mother with clues as to the meaning of the cries.	☐	☐	☐	___	42
38.	The newborn with stomach discomfort usually draws his knees up to his tummy and cries loudly.	☐	☐	☐	___	43
39.	Picking up a crying newborn will "spoil" him.	☐	☐	☐	___	44

		TRUE	FALSE	NOT SURE	For Office Use Only	
40.	Covering the naked newborn's arms and legs with a towel or blanket will stop crying which is due to exposure.	☐	☐	☐	___	45
41.	Mothers often feel angry with their newborns if their babies continue to cry after every effort has been made to comfort them.	☐	☐	☐	___	46
42.	The newborn will start to make cooing sounds around one month of age.	☐	☐	☐	___	47
43.	The newborn can be expected to sleep an average of twenty hours per day.	☐	☐	☐	___	48
44.	The newborn should sleep on a firm, flat mattress.	☐	☐	☐	___	49
45.	Positioning a newborn on either his side or stomach is considered to be a safe position for sleeping.	☐	☐	☐	___	50
46.	The bowel movements of the newborn are expected to be pale yellow during the first two to three days of life.	☐	☐	☐	___	51
47.	The stools of the breast-fed newborn are generally dry and have a foul odor.	☐	☐	☐	___	52
48.	Constipation is a common problem in the newborn.	☐	☐	☐	___	53
49.	The best sign of diarrhea or constipation in the newborn is the appearance of the stool.	☐	☐	☐	___	54
50.	The newborn can be expected to urinate an average of eighteen times per day.	☐	☐	☐	___	55

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APPENDIX D

PERSONAL DATA FORM

NEWBORNS AND THEIR CARE

Women who are expecting their first baby and who wish to use the instructional materials on NEWBORNS AND THEIR CARE, please fill out this form, complete the attached test, and return both the form and the test before leaving the room.

NAME_____ AGE: 15-20_____

21-25_____

ADDRESS_____

26-30_____

_____

31-35_____

_____

Over 35_____

PHONE NUMBER AT HOME_____ PHONE NUMBER AT WORK_____

EXPECTED DATE OF YOUR BABY'S BIRTH_____

LOCATION OF PRENATAL CLASSES ATTENDED_____

DOCTOR'S NAME_____

WHERE IS IT MORE CONVENIENT FOR YOU TO BE REACHED BY PHONE?

AT HOME_____ AT WORK_____

WHEN IS THE BEST TIME FOR YOU TO BE REACHED BY PHONE?

MORNINGS_____

AFTERNOONS_____

EVENINGS_____

CIRCLE THE TIMES YOU COULD BE AVAILABLE TO USE THE INSTRUCTIONAL MATERIALS.

MORNINGS: 9-10 10-11 11-12

AFTERNOONS: 1-2 2-3 3-4 4-5

EVENINGS: 6-7 7-8 8-9 9-10

APPENDIX E

INSTRUCTIONS GIVEN TO SUBJECTS

PRETEST INSTRUCTIONS

Subjects Pretested at Prenatal Classes

I am asking everyone who participates in the project to take a few moments to fill out two forms for me. One will provide me with information about you; for example, your name, address, phone number, etc., so I will know how to contact you to arrange for a convenient time for you to come to the University to start the program. The second form is a short quiz. It contains 50 statements about newborns and their care. Next to each statement, I would like you to indicate whether you think the statement is true, false, or whether you are not sure if it is true or false. The purpose of the quiz is to find out what pregnant women in this area know, don't know, or aren't sure of in relation to the characteristics and care of newborns. The quiz will provide me with direction for developing other instructional programs for pregnant women in the future. Do you have any questions?

I would like those of you who are interested in taking the program to take a few minutes now to complete the two forms for me. I will contact you by phone within the next two weeks to arrange a time for you to come to the University to start the program. Thank you for your attention.

Subjects Pretested at the First Experimental Session

I am asking everyone who participates in the project to take a few moments to fill out two forms for me. One will provide me with information about you; for example, your name, address, phone number,

etc., so I will know to contact you. The second form is a short quiz. It contains 50 statements about newborns and their care. Next to each statement, I would like you to indicate whether you think the statement is true, false, or whether you are not sure if it is true or false. The purpose of the quiz is to find out what pregnant women in this area know, don't know, or aren't sure of in relation to the characteristics and care of newborns. The quiz will provide me with direction for developing other instructional programs for pregnant women in the future. Do you have any questions?

Additional instructions to subjects in the experimental group. After you have completed both forms, let me know, and I will get you started on the next part of the program.

Additional instructions to subjects in the control group. After you have completed both forms, let me know, and we can make arrangements for you to return for the next part of the program when it is convenient for you.

PROGRAM INSTRUCTIONS

Subjects Beginning Unit One

This is Unit One of the program. The first few pages of the booklet will provide you with an overview of the material you will cover in the whole program, and a description of how to use the booklets and the slides. This machine on your desk will be used to project the slides which accompany each unit. To turn the machine on, you simply push this button marked ON. To turn the machine off, you push the same button. To advance the slides forward, push this button marked ADVANCE. If, at any time, you would like to review any of the slides, push the button marked SELECT, hold it down, and rotate the carrousel like this (demonstration) until the number on the carrousel which corresponds to the number on the slide you would like to review is lined up with this groove on the top of the machine. If you have any questions, or problems with the machine of the booklets, let me know and I'll help you with it.

Subjects Completing Each Session

When would be a convenient time for you to return for your next session? (The date and time were recorded in an appointment book along with the number of the Unit on which the subject would be working. An appointment reminder card was filled out and given to the subject along with the following verbal instructions.)

If you find that, for some reason, this time is not convenient for you, give me a call at the number on the appointment card, and I

will make another appointment for you. I will be available at that number after 11 o'clock in the evening, or before 8:30 in the morning.

Subjects Beginning Subsequent Sessions

Hello _____ (subject's name). You're ready to start Unit _____ (number of Unit) today. Please take a seat, and I'll get you started right away.

POSTTEST INSTRUCTIONS

Subjects in the Experimental Group

Would you please take a few moments now to complete this quiz? It is not the same quiz which you completed previously, but you will probably find that it is similar.

Subjects in the Control Group

Would you please take a few moments now to complete this quiz? It is not the same quiz which you completed previously, but you will probably find that it is similar. After you have completed it, let me know, and I will get you started on the next part of the program.

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